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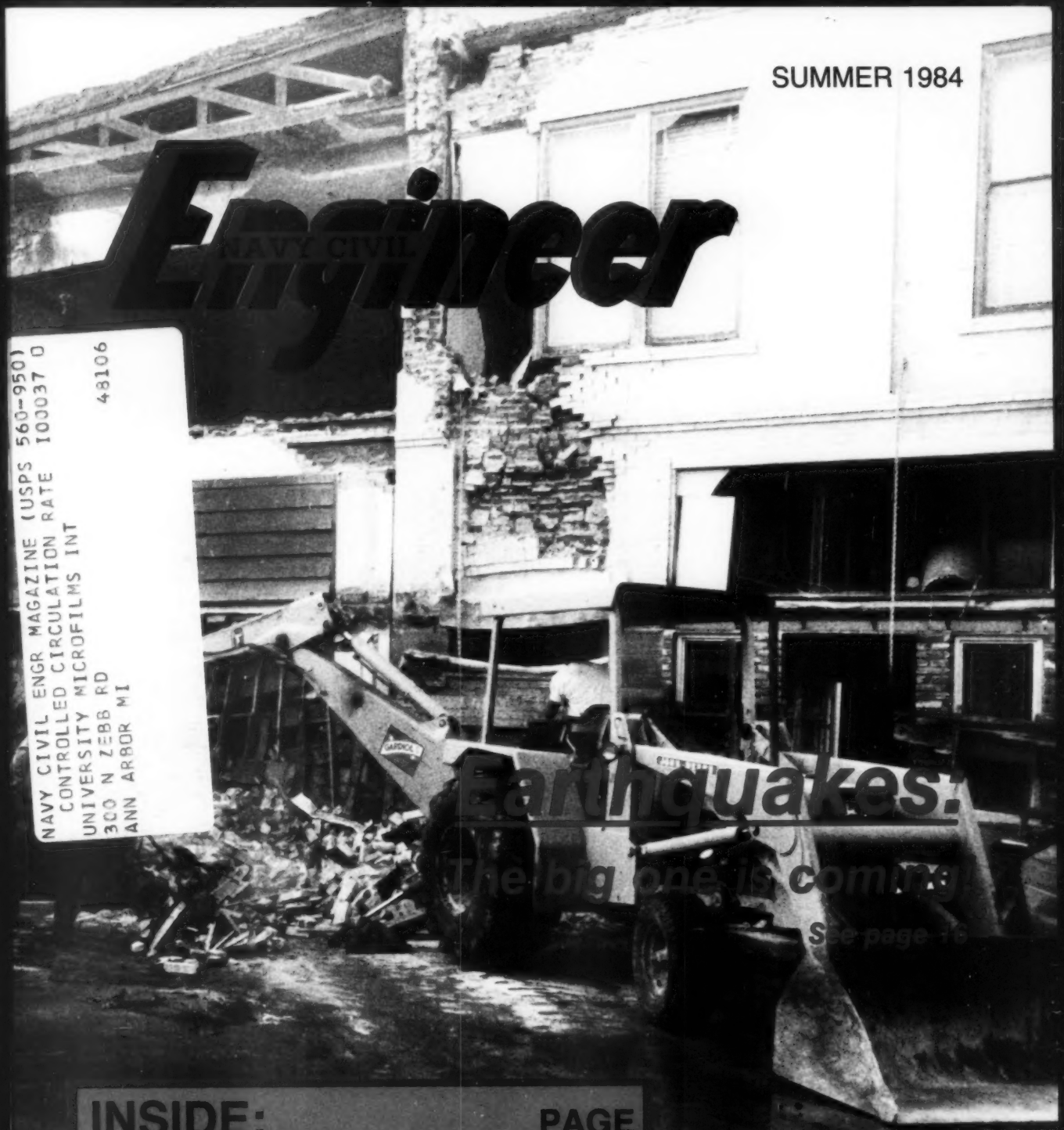

Earthquakes.

The big one is coming!

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THE COVER

The destruction of earthquakes was seen recently at Coalinga, California, and not a pretty sight to see. Geologist PH1 John M. Buffalo tells why this natural phenomenon occurs and discusses the best documented part of America for earthquakes — California. The photos illustrating Buffalo's article were taken by photographer Craig Smith of the *Hanford Sentinal*, Hanford, Calif. Buffalo's article begins on page 16.

Navy Civil Engineer

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Litigation: We can't escape it!

". . .the trial is a method by which we get decisions — not necessarily acceptable but which must and therefore will be accepted." Morris B. Abrams

Every large organization (public or private) in this country today must be prepared to litigate hundreds of suits. Litigation is merely a structured, rational means of settling differences, before some tribunal — distinguished both from decision without participation or review (arbitrary, uncontrolled, often unarticulated) and from irrational determination (trial by battle, walking over hot coals, roll of the dice).

Litigation requires in some form opposing statements of position, disclosure of information, presentation of witnesses and other evidence, argument orally or in briefs, a decision stating reasons, and some right to appeal.

The litigation course is governed by rules of procedure, and decisions are based upon statutes, regulations, previous decisions and the evidence presented.

Litigation against a NAVFAC action often begins with a protest to the Comptroller General (which must be received within 10 days of awareness of the action). The comptroller calls upon the protester to set forth the basis for his complaint and upon the contracting officer to furnish a full documented report.

He may hold a conference for evidence and argument, may dismiss the protest if substantiation is not furnished, or if it is late, or if not by an interested party, or if before a court; and he renders a written decision.

He may deny the protest, warn of improprieties, or nullify the procurement by disapproving use of appropriated funds. NAVFAC has been receiving about forty protests a year and must take some corrective action one or two times a year.

Once a contract is awarded, claims may be made under the Contract Disputes Act, proceeding from Final Decisions (233 last calendar year, 1981) through appeal to the Armed Services Board of Contract Appeals (159 appeals pending as of 31 December 1981), whose decisions may be reviewed by the Court of Claims.

The Command may offer a Chief's Board hearing before important, controversial final decisions. Claims under $50,000 may proceed by accelerated or expedited procedures.

The Court of Claims may be asked to review ASBCA decisions for violations of law or lack of substantial evidence, or suits on claims may be brought directly in that court. That court may also entertain suits for "takings" of property or to quiet title or for military or civilian pay.

The Court of Claims lacks jurisdiction to enjoin; but other federal courts may enjoin procurement awards or other actions found to be illegal.

Operations may be halted by a temporary restraining order (TRO) (no hearing), preliminary injunction (expedited hearing), or final injunction (after full trial). Suits may be brought in state or foreign courts against NAVFAC officers. NAVFAC is concerned in some sixty pending suits. Counsel took some steps in 1981 in connection with 22 cases and deal with two or three injunctions a year.

In connection with litigation, requests may be made for documents or information by discovery or freedom of information requests, which are virtually litigation because governed by elaborate rules and providing for review and prompt court suits. Some two or three FOIA requests must be handled every week.

Counsel also handles public utility rates proceedings before state commissions, or applications to federal administrative bodies, such as the Federal Energy Regulatory Commission, Department of Labor hearing examiners or its Wage Appeals Board, etc.

They may appear before state air quality control boards; or planning and zoning boards. Perhaps a dozen PUC and another dozen state proceedings may occur in a year.

All litigation requires the skills of a lawyer — attention to legal rules, careful preparation of facts and evidence, and persuasive respectful argument, so that differences are at least settled and hopefully settled in the command's favor.

So you think we're clean enough

By LCDR T. A. LABOON, JR.,
CEC, USN
Director, Environmental Quality Division
NAVFACHQ

It can be justified easily to show that we have taken significant strides in correcting the Navy's pollution deficiencies through our centrally managed environmental protection program. Since FY 1968 we have spent over $700 million in military construction and achieved nearly 99% compliance with our air pollution sources and 75% compliance with our water pollution sources.

In addition to a headquarters staff, we maintain a professional group of environmental engineers at each of our field divisions, have created a technical environmental staff within the Naval Energy and Environmental Support Activity (NAVENENVSA), and have established three specialty offices to deal with ship, aircraft, and ordnance pollution items.

Together, we have solved each of the major environmental issues facing the Navy and kept our fleet operational. Oddly enough, however, there is a danger in this. By continually solving the problems in an organized manner, doing our job well, some begin to think environmental problems no longer exist and

Additional and tougher standards are being established

resources no longer are needed, or can be reduced, to support this effort.

In a crises oriented, resource limited world, success can lull one into an unhealthy sense of complacency. In our ever changing environment, this should not be allowed to happen.

Many have advocated reducing the nation's environmental efforts, calling the initial goals over ambitious and achievement of those goals unrealistic and too costly. This attitude, spurned a chain of events that seemed to strengthen the environmental movement rather than weaken it. For example, proposed environmental program reductions forced environmental groups to focus their energy on substantive issues, produce facts rather than rhetoric, and deal with complicated economics.

In successfully doing so, they have improved their image and credibility, consequently attracted additional supporters and further strengthened their political influence. Such influence has been openly demonstrated recently in their successful opposition to many of former Secretary of Interior Watts' proposals and proposed relaxation of EPA regulations.

The highly publicized resignations and firing of senior level EPA officials over alleged "sweetheart" deals with industry only served to add fuel to the environmentalists' fire.

The nation's current fear of hazardous wastes has heightened further the resistance to relaxation of the environmental regulations. National polls reflect this in their results, Congress is unable to agree on changes to the laws, and the environment looms as a significant issue in the 1984 elections. All of these items are signs that environmental protection is a serious national concern that cannot be ignored.

What does all this mean to the Navy? Isn't DOD the fair-haired child of the administration? Don't we have federal supremacy? Don't military operations take precedence? The answers are not all a resounding "yes."

Congress has seen fit to mandate our compliance with all substantive and procedural state and local environmental regulations. Exemption procedures for military operations do exist in most cases, but are considered a last resort and have never been exercised within the Navy. Furthermore, because DOD now has a substantial portion of the federal budget, we are expected to be able to pay our fair share — no special rates!

Broadly speaking, this means we must be even more conscious of the environmental effects of our operations than we were in the "environmental decade" of the 1970s. As state and local regulatory agencies begin to assume primacy in enforcement from the EPA, they are establishing tougher standards and looking closer at our business.

This is occurring for two reasons, possibly more: They want to show the federal government they are just as "tough" if not more so, and they now have a more personal interest in protecting their own turf. We must be aware of this and begin to deal with it. We must establish close liaison with those regulators to ensure they understand our operations.

We need to work with them in the development of their regulations to give consideration to those operations.

We also must negotiate compliance schedules where we are unable to comply immediately due to our Congressional budgetary approval process.

How does this affect us specifically? One way is permit renewal. While we thought we had met the majority of the regulatory requirements and were hoping for a "breather," the permit renewal process has taken on a new look.

Additional and tougher standards are being established, such as total toxicity and pretreatment, that are requiring us to take another look at our pollution abatement measures. Consequently, while we have achieved very successful levels of compliance in the past, staying in compliance in the future will require a substantial level of effort.

Concurrently, national concerns with hazardous waste and groundwater protection are creating new, very stringent regulations with long term resource requirements. As our technical capabilities to detect contaminants increase to parts per trillion, so does the public's concern, and hence the increasingly strict limitations. In fact, many environmental groups are pressing for "zero-discharge" or "non-detectable limits."

Situations such as those recently publicized in Hawaii and Florida over pesticides in their drinking water sources are forcing their regulators to initiate strong remedial and protective measures.

In Pearl Harbor, this problem has the potential to affect nearly 75% of the Navy's water supply. Understandably, the solutions to these problems are difficult, highly technical, and subject to much public debate.

To further assist in the identification of potential groundwater contamination on our installations, our Navy Assessment and Control of Installation Pollutants (NACIP) program has been underway since 1980. We have identified nearly 100 Navy activities to receive the first phase (initial assessment) of this three phase NACIP program.

As of December 1983, NAVENENVSA, who is centrally managing the first phase efforts, has either completed or initiated 62 studies. We have investigated 769 sites and find that on the average we must conduct the second phase (confirmation study) for 31% of the sites. While we expect to complete the first phase efforts sometime in FY 1986, the engineering field divisions may be conducting the second and third (remedial actions) phases into the late 1980s.

This program parallels the nations's "superfund" efforts in the civilian sector, although federal activities have not been included on the Environmental Protection Agency's (EPA) national priority list (NPL). We now expect, however, to be included on the next update of the NPL. This should increase significantly the public attention our NACIP efforts receive. We must be prepared to respond to the pressures that may result from this.

The myriad of problems associated with the proper management of hazardous wastes will be with us for some time. Nearly everything we handle on board ships can be considered hazardous and the list is growing. The current EPA proposal to consider used oil as a hazardous waste would have a significant impact in our operations if approved.

Concerns with the costs of disposal of these hazardous wastes is causing us to review our emphasis on reducing the waste stream through recycling, material substitution, and alternative opertional processes. We have only begun to feel the initial effects of dealing with hazardous wastes and there is no relief in sight.

Where will all this lead us? Similar to our role as the defender of our nation, we and DOD as a whole may become the defender of our environment. It sounds incredible but it is not so unlikely in the long term. This is because we are a very discernible, federal entity, subject to the taxpayer, with relatively large and secure land holdings.

We are being required to correct our pollution deficiencies, possibly with somewhat more vigor than private industry because we can set the federal example. Even more disturbing is the real potential to be forced to act as a storage, treatment or disposal site for some of the nation's (non-DOD) hazardous wastes.

This possibility is driven primarily because of siting difficulties in our surrounding communities. Congress could "bail-out" their constituents by causing the military installations to do it. Although DOD has a policy not to accept non-DOD generated wastes, we must continue to vigorously oppose such outside pressures.

How will our future environmental efforts be spent? They will continue as in the past — identifying deficiencies, developing technical solutions, negotiating compliance agreements, constructing pollution abatement facilities, monitoring and reporting our efforts and protecting our installations and commanding officers from undue outside environmental and political pressures. We have been successful with this in the past and expect equal success in the future. □

Status of NACIP Program (as of Feb 29, 1984)

Initial Assessment Studies	
Activities planned for IASs in FY 1981-1984	73
Number of IASs initiated	67
Number of final IAS reports	42
Number of sites identified	842
Number of sites recommended for CS (32.1% recommended for CS)	270
Confirmation Studies	
Activities requiring a CS	37
Number of studies initiated (studies initiated address 122 sites)	16
Number completed	3
Number of sites requiring remedial measures	3
Remedial Measures	
Activities requiring projects	6
Number of sites requiring projects	9
Number of projects initiated	3
Number completed	0

Red Hill Facility modernized

By HIROSHI KOJIMA
P. E., Hawaii
AND
GLENN H. HIGUCHI
P. E., Hawaii
PACDIV NAVFAC

Imagine a group of 20 underground tanks, each about the height of a 25-story building, buried deep in a mountain ridge. Each tank can hold 300,00 barrels of fuel. This is the Red Hill Fuel Storage Facility located a few miles from Pearl Harbor, Hawaii.

Within Red Hill, a $30 million tank repair project is nearing completion. The project was initiated with change of stored fuel from higher viscous Navy special fuel oil (NSFO) to lighter and more corrosive JP-5 and diesel fuels. Basic scope of the project is repair and coating of internal steel linings for 16 of the 20 tanks. The other four tanks were repaired and coated in 1960.

Scope for the tank work also includes removal of telltale systems, installation of new sampling systems and repair of tank valves.

Construction work is being administered by the officer-in-charge-of-construction, NAVFACENGCOM Contracts Mid Pacific (OICC MIDPAC) and his staff.

To appreciate the magnitude and complexity of the project, the fuel storage facility must be visualized. The tanks are cylindrical, 250-feet high and 100-feet in diameter, with 50-feet radius domes at top and bottom. Tanks are basically reinforced concrete tanks, 2 to 8 feet thick, lined with steel plate. Each tank is entirely lined with 1/4-inch steel plate except for 1/2-inch plates used for the 30-feet diameter tank bottom. Each tank has almost 2 acres of surface area and about 5 1/2 miles of weld joints.

Visualize 20 of these tanks in two straight rows, 200 feet apart on centers, running parallel within a narrow mountain ridge. At least 100 feet of soil and rock covers the top of the tanks. Centered between the rows are two tunnels, one approximately 200 feet above the other, connected by two elevators.

The upper tunnel has its floor at the base of the upper dome of the tanks and the lower tunnel is about 18 feet below the tank bottoms. Branch tunnels from both upper and lower tunnels lead to each tank, with the lower tunnel system carrying the maze of interconnecting fuel piping and valves, and the upper tunnel providing personnel and equipment access to each tank.

Access of personnel and minor pieces of equipment is allowed by a 24-inch diameter manhole, located on a larger, 8-foot diameter flanged "man-way" cover at each upper branch tunnel. Removal of the cover allows access of large pieces of equipment necessary for tank maintenance and repair. Within each tank, a steel catwalk joins the access manhole to a center elevator tower. An air-operated steel cage elevator allows workers to reach tank bottom.

The large and non-standard configuration of the tanks and fuel storage complex presented special problems in sequencing of work operations. Work scheduling required consideration of not only the sequence of work operations but also of fuel storage logistic requirements.

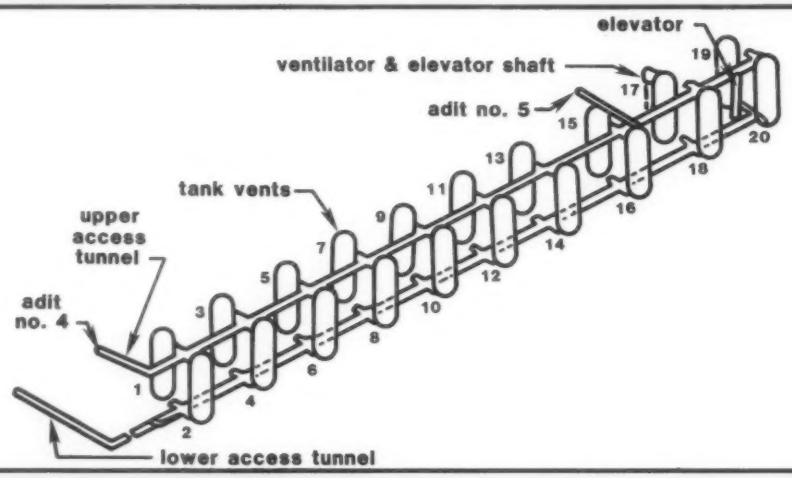
The Contractor was allowed only four tanks to work on at any given period. Constant communication was required between the OICC and the using activity to coordinate the construction with the operational activities of the facility.

SEQUENCE OF WORK OPERATIONS

Empty Fuel from Tanks

This operation had a major impact on scheduling since it required three to four days to fill or empty a tank at a transfer flow rate of 4,900 to 8,750 gallons

Fuel storage tanks and access tunnels



per minute. Fuel piping to tanks being repaired was isolated from the remainder of the active fuel storage complex.

Tank Wash Down

The tank surface was hosed down with fresh water to remove fuel residue and expedite degassing of the tank. The waste was drained to a holding pond exterior to the fuel storage complex and then trucked about three miles to an oily waste treatment plant for processing.

Install Compressed Air & Ventilation System

Compressed and dehumidified outside air was supplied by a $300,000 plant built by the contractor for this project. The plant included two air compressors of 2600 CFM at 115 to 125 PSIG, storage tank, dehumidifiers, cooling tower with water circulation pumps, and three dust collectors. Compressed air was piped from this exterior plant to each tank under repair. Dehumidified outside air was supplied to each tank through a 32-inch diameter air duct system. The ventilation system utilized existing facility exhaust fans to the maximum extent.

This was supplemented by various combinations of supply and exhaust fans which were used to satisfy requirements during the different phases of tank work. This included tank degassing, general work, sandblasting, welding and coating operations. Ventilation air was, for the majority of tank work, forced through the tank from the upper to lower access tunnel. The concentration of solvent vapor during tank coating was kept below OSHA and explosive limits. A dust collection system was used in the lower tunnel during sandblasting and coating operation.

The specifications required that tank coating operations could take place only when steel liner surface temperature was a minimum of 5°F above the dew point temperature of air within the tank. To insure this condition would be met, the contractor was required to provide and introduce dehumidified outside air into the tank to mix with tunnel air. This air mixture also provided optimum conditions to delay blushing or rusting of white metal after abrasive blasting.

Install Scaffolding System

An innovative platform scaffolding system was designed and constructed by the contractor for work on difficult to reach tank upper dome interior surfaces. A rotating truss system was mounted on the reinforced center elevator tower. Air-powered platforms moving up and down an inclined track attached to the trusswork allowed workers to reach upper dome surfaces.
cd

To work on vertical walls and lower domes of the tank, workers operated air-driven scaffold platforms. These platforms were suspended by steel cables to trolley hoists rolling on monorail tracks installed at the base of the tank upper dome, three feet below the catwalk level. When it became necessary to re-enter the tank for additional leak repair after completion of basic tank work, a lighter, easier to install, telescopic boom with a "cherry-picker" platform was used instead.

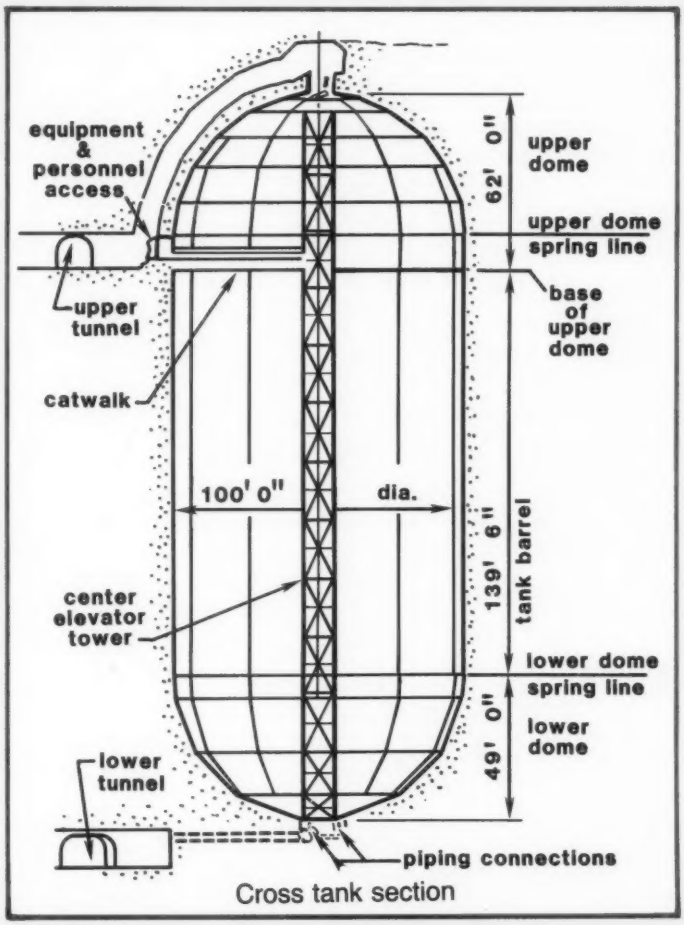
Install Lighting

The deep cylindrical tank presented a difficult problem in adequately lighting the tank surface. Dust and paint vapor mist, formed during sandblasting and painting operation, compounded the lighting problem. Bright strobe lights were installed on the catwalk and center tower to light the drab interior steel surfaces. Spot lights mounted on scaffolds and work platforms and additional hand-carried high intensity portable lights were used during the critical inspection, welding and coating work. All lighting utilized explosion-proof fixtures.

Tank Cleaning

The tank surface required cleaning prior to inspection. Washing down with detergent was considered but not attempted due to waste disposal problems. Since scaffolding was to be provided for follow-on white metal blasting, light "brush" sandblasting was selected as the optimum method to clean the tank surface.

Tank surface fuel residue waste was analyzed and



Cross tank section

Tank grit removal was a major problem

found to be acceptable for disposal in land fills. Black Beauty or Green Diamond sand was used as sandblast grit. A sandblast grit reclaiming and storage hopper was located adjacent to the air compressor station. Grit was pneumatically piped to and from the work site. Sandblasting equipment was placed in upper tunnel branches. A major problem was removal of hundreds of tons of grit from the tank bottoms.

A considerable amount of cement grout was found attached to tank walls.

Inspect Tank Surface

Surface areas and weld joints were visually inspected. Suspected defective welds appearing as porosity, slag entrapment, weld splatter, undercuts, voids and lack of penetration were ground smooth and radiographed, where required. In addition, each linear foot of weld joint was inspected by soap bubble/vacuum testing.

Repair Tank Lining

All defective and suspect welds were ground down and re-welded. Numerous angle clips, pipe stubs and other protrusions found welded to the tank lining were cut off and ground smooth. Corrosion pits in the tank bottoms were filled in with weld material. In isolated locations, where corrosion was extensive, steel patch plates were welded on.

Repair of the upper domes presented a major problem because of backing strips over plate welds. Specifications allowed options to either completely remove the backing strips and repair the weld joints or completely seal weld strips along both edges. Back-up strip removal was found too labor intensive. It was found difficult to satisfactorily seal weld back-up strips because of residual oil seeping from under the strips.

Isolated punctures of steel plates were located and repaired with steel patches. These punctures had occurred during tank construction but over the years had remained sealed by NSFO fuel.

White-Metal Sandblast

The tank surface was sandblasted to white metal to a surface profile of 1.0 - 2.0 mils prior to application of coating. Steel grit #80 was used as sandblast grit for this application since the white metal surface would begin to rust in about 24 hours. If left uncoated, the sandblasting and coating application were done in increments of 25% of the tank surface at a time.

During blasting operations near the bottom of the tanks, it was sometimes necessary to use suction cups on the tank wall. Reactions from sandblast nozzles tended to push the working platforms, hanging on wire cables, away from the wall.

Tank Coating

The coating system specified was a Navy Research Laboratory (NRL) formulated 4 coat, 6 mils dry thickness, urethane system. This coating was specially developed for these Red Hill tanks, and was initially used in 1960 on four of the 20 tanks. Based on satisfactory service over the years, the NRL system was again specified for the remaining 16 tanks.

While conventional spray guns were used in 1960, current use of industrial airless spray guns posed some initial difficulty in the increased amount of solvent deposited on tank walls. It was difficult to apply 6 mils dry thickness in the required number of coats without sagging of the coating. A subsequent change was made to the coating formulation to correct this problem.

A property inherent with the urethane coating is its attraction for moisture. Moisture condensate from stored fuel collects on the tank bottom. As a result, tiny blisters up to 1/4-inch diameter forms on the coating at the tank bottom.

Experience has shown, however, these blisters are tough and do not appreciably detract from the superior protective properties of urethane coating.

Aluminum metallizing was applied to the tank bottom to prevent formation of blisters. Metallizing requires skillful applicators and it was difficult to maintain good quality control during the metallizing procedure. It does not appear that metallizing of tank bottoms accomplished the purpose of preventing blister formation of the coating.

The final coating appeared to be tough and pliable with a glossy, dark green color. The coating was tested for pinholes or holidays with a low voltage holiday tester.

Leak Tests

Upon completion of the repair/coating work, the tank is filled with fuel and tested for leaks. The tank is isolated from the fuel piping system at the bottom of the tank and the tank fuel level observed closely. Because of the large volume of the tank and its cylindrical shape with hemispheric ends, cooling of the fuel of only few degrees can cause an appreciable contraction of the fuel with resulting large fuel level drop at the top of the tank.

It has been determined through experience that temperature effects can affect observed volumetric change rates for periods up to one year. When it is determined that a tank is leaking, the tank is emptied and re-entered to search for and repair leaks.

CONCLUSION

Prior to initiation of design of this repair project, sample cutouts were made of the 1/4-inch steel liner on the lower wall and the 1/2-inch steel tank bottom plate to determine exterior condition of the 40-year-old tanks. The exterior of the steel plates were found to be in almost new condition with mill scale intact.

Now with the successful completion of this project, the interior of the steel lining will be completely repaired and a tough protective coating applied over it. This will insure that the Red Hill tanks will be providing dependable service as a major POL storage facility for a long, long time. □

CIVIL ENGINEER CORPS SURVEY - The Chief of Civil Engineers has agreed to provide support to the Navy Occupational Development and Analysis Center (NODAC), a detachment of Naval Military Personnel Command, in conducting a study of the Civil Engineer Corps. This will be a feasibility study intended to document officer job responsibilities which distinguish paygrade ranges for different types of jobs within a designator. The methodology developed in this pilot study will potentially be used to assist the CEC and ultimately the Navy in documenting, justifying, and managing officer billet paygrade decisions. This pilot study will involve completion of a survey by 100% of the Civil Engineer Corps officers. A letter from the Chief along with a survey booklet was mailed to each CEC officer in April 1984. CEC point of contact is LtCdr J. D. Camp in the CEC Detail office, Comm (202) 694-3635, AV 224-3635.

(NAVFAC Code 09MA2)

CORROSION CONTROL OF SHORE FACILITIES - NAVFACINST 11014.51 establishes policy and responsibility for corrosion control at shore facilities. To minimize change and insure maximum readiness, commanders/commanding officers are required to designate a person to be responsible for a corrosion control program and notify EFD Code 10s of corrosion control problems and the need for assistance. The instruction lists structures that shall have cathodic protection, provides guidelines for revising local instructions to emphasize an effective corrosion control program and describes assistance available.

(NAVFAC Code 10)

PROJECT smart - The team has completed the specifications for the first module, the Contractor Information Module. It is currently being reviewed by the EFDs and Headquarters. Procurement of the computers is progressing well. August is the target for a contract award. The EFDs are encouraged to use their Four Phase equipment for local systems until the smart computers arrive. Local systems developed at WESTDIV are available for review and use. Techniques to pass construction status data from the EFD Four Phase computers to ROICCs with WANG OIS systems have been developed and will be exported shortly.

(NAVFAC Code 011)

news worth reviewing

departments

Sailors move into new highrise barracks

The first sailors to occupy the new 15-story highrise began moving their belongings into their new rooms recently.

Located behind the Enlisted Men's Club at the Pearl Harbor Naval Station, the building is the first of its kind for enlisted personnel in Hawaii according to Public Affairs Officer Jeanne A. Light.

Captain Michael G. Clarity, Commanding Officer, Naval Station, Pearl Harbor, noted that the opening of the new building is part of the Navy's continuing program to improve quarters for its service men and women.

The cost for the new 192-unit building breaks down to approximately $17,000 per room, which Capt. Clarity noted "is a bargain considering today's real estate prices." Each room can accommodate one to three enlisted persons for a total capacity of 432 occupants.

Approximately $900,000 was spent on furnishings, and the rooms include telephone and telephone jacks, refrigerators, bathtubs, Casablanca fans, smoke alarms and a fire sprinkler system, tinted windows, and brand new area carpets.

The building's staggered design makes for a very attractive outward appearance which could rival many of the better highrises in town. And the downstairs lobby and office spaces are similar in style to the lobbies of many Waikiki Hotels.

Included are a reading room, laundry room, telephones, a television room and plenty of "hotel-type" open space. Eventually video cameras with 24-hour replay will ensure building security at entrances and the three elevators.

Pete E. Tafoya, Director of NCEL's Facilities Support Engineering Office, proudly wears the Padrino Award Medal given to him by MAES. Admiring the award is NCEL's Technical Director Dr. D. L. Birkimer (right).

MAES bestows award on Pete E. Tafoya

Pete E. Tafoya, Director of the Facilities Engineering Support Office at the Naval Civil Engineering Laboratory (NCEL), Port Hueneme, Calif., was awarded the Padrino Medal, the highest honor bestowed by the Mexican-American Engineering Society (MAES) to its members.

Tafoya was presented the gold one-ounce medallion at the recent annual MAES symposium in Albuquerque, N.M. He was honored for his outstanding leadership, example to student members, and dedication to society goals.

Also, a scholarship in his name has been awarded to a worthy Mexican-American university student.

Born in Visalia, Calif., Tafoya is a grduate of the College of Sequoias, Visalia. A registered Professional Engineer in California, he is a candidate for a PhD in mechanical engineering from the University of California at Santa Barbara.

CEC reservists train with LANTDIV

Forty-nine Civil Engineer Corps naval reservists trained recently with senior members of Atlantic Division, Naval Facilities Engineering Command.

The 49 reservists represented three naval reserve units: Engineering Field Division Chesapeake/Atlantic (Ches/Lant), Officer in Charge of Construction (OICC) Mediterranean and OICC Southern Europe. They came from eight states for the two-day weekend away for training.

Capt. A. S. Poole, LANTDIV's vice commander, kicked off the session. He said that every Navy person should be ready for combat at all times.

He also said Navy facilities managers must operate at the margin. By that he meant that CEC officers must make sure that every dollar they say is needed to build and maintain facilities is producing a return to the fleet.

Capt. Gutzwiller pointed out during the RDNAVFAC command briefing that reserve facility support officers provided some $376,000 worth of services to the Navy in FY83.

"Of the 242 naval reserve centers in the U.S., RDNAVFAC's FSOs support 235. That's 1.64 reserve centers per FSO," said Capt. Gutzwiller.

Woman at CECOS gets Navy's highest civilian award

Eileen S. Hunt, civilian employee of the Navy at Port Hueneme, has been awarded the Navy Meritorious Civilian Service Award for her "exceptional service to the Naval School, Civil Engineer Corps Officers." Mrs. Hunt, who is the Student Services Clerk at the school, was presented the award during a graduation ceremony recently by RAdm. Joseph B. Wilkinson, Jr., USN, Commander, Pacific Missile Test Center, Point Mugu, and Captain John L. Dettbarn, Commanding Officer of the school. The award is the highest award that can be given to a civilian by a Navy field command.

Mrs. Hunt has been in her present position since 1978 but has been employed by the school for the last 16 years and has been in federal service for a total of 28 years.

The school registered about 2,500 students last year, of whom about half were civilians and half Navy personnel; many of them new officer recruits from all over the nation. According to Kay Henderson, school Administration Officer, who nominated Mrs. Hunt, "Mrs. Hunt has made an exceptional contribution to the Navy and its education and training mission. Her commitment, attention to detail, and devotion to duty have provided CECOS with continually outstanding student and administrative services . . . . She is one of the most professional civilian employees with whom I have had the pleasure of serving during my career."

Eileen Hunt receives the highest Navy medal for a civilian, the Meritorious Civilian Service Award. Doing the pinning is RAdm. Joseph B. Wilkinson, Jr., Commander, PMTC, Pt. Mugu, Calif.

"Commodore" Hunt, as she has been affectionately known throughout the Civil Engineer Corps, has received 12 Outstanding Performance Ratings in the last 16 years, eight were accompanied by cash awards for sustained superior performance, and three included salary increases.

When queried about the award, "Commodore" Hunt stated, "Was I surprised. Never in a million years did I suspect anything like this. It was very emotional . . . a wonderful feeling . . . and I'm very grateful." Then, with her usual concern for others taking over, she added, "It's great for the school, too."

Seabee Day proclaimed across land

"Seabee Day" has been proclaimed across the country in nine states, four cities and one county, not to mention the U.S. Senate and House of Representatives.

Acting on an idea conceived by RAdm. Thomas S. Maddock, Commander of the Reserve Naval Construction Force, the regimental and battalion commanders of the force went to work. And the rest, as they say, is history.

The governors of California, Colorado, Connecticut, Georgia, Illinois, Indiana, Michigan, New York and West Virginia; the mayors of Chesapeak, Va., Granite City, Ill., Long Beach, Calif., and New York, N.Y.; and the supervisors of Orange County, Calif., went on record in acknowledging the exploits of the Navy's Seabees since their inception in 1942 and proclaimed March 5 as "Seabee Day." The date coincides with the Seabees' birthday.

One state's governor, William A. O'Neill of Connecticut, proclaimed the entire month of March in honor of the Seabees.

The Seabees are the premier construction experts of the nation's military forces. Their legacy since World War II is one of incredible feats performed under often unbelievable circumstances.

Today, some 70 percent — 18,000 — of the Navy's Seabees are vested in the Reserve Naval Construction Force. This nationwide command is comprised of eight regiments and 17 battalions. Each battalion is made up of about 750 officers and enlisted.

Reserve Seabees on Peruvian adventure

Fourteen men from RNMCB-16 and 17 are engaged in a 17-day training exercise in Peru.

The detachment left Marine Corps Air Station, El Toro, Calif., May 25 enroute to Peru via Savannah, Ga., and Panama. They arrived in Lima on May 27.

Their job is assisting a Peruvian Navy project team in clearing and repairing storm damage to a Navy base at Callao.

Members of reserve Seabee Detachment Callao board a Navy C-9B transport plane at Marine Corps Air Station, El Toro, Calif., enroute to Peru. Commander James Weston (right) of the Reserve Naval Construction Force headquarters staff provides the traditional Seabee on-deployment farewell.

After receiving the go-ahead from the Chief of Naval Operations, all necessary arrangements and paperwork were completed, and the group airborne, in a little more than two weeks — a process which normally takes up to three months.

While in Peru, the detachment is being supported by the Peruvian Navy, which is providing room and board, laundry service, transportation and materials.

In addition to being international in scope, the operation is an example of U. S. inter-service cooperation: transportation to and from Peru involves Navy, Air National Guard and Military Airlift Command (Air Force) resources.

RNMCB 16 is based at Los Alamitos, Calif.; RNMCB 17 is from Port Hueneme, Calif.

Potable water-pipe rehabilitation made easier

By B. I. AZAR
P.E., Wis.
and
J. J. HARWOOD
P.E., Va.
LANTNAVFACENGCOM, Norfolk, Va.

Rehabilitation of potable water pipe lines is expensive and is becoming more of a problem because of the age of the Naval systems. Many were installed in the 1940's and 1950's and have deteriorated to the point where they are no longer adequate to meet current or future demands and pipe rehabilitation may be needed. A description is given of LANTNAVFACENGCOM's "Water Pipe Rehabilitation Guide" to provide assistance in determining where and what type of rehabilitation is appropriate.

Prior to the beginning of a pipe rehabilitation project, the scope of the rehabilitation should be developed through a study of the system needs and tests made to determine existing conditions. Typically a complete study should include the following items.

- If needed, updating the system maps showing piping, sizes, elevations, and valve locations.
- Estimation of current and future water usage and fire flow rates in each section of the system.
- Hydraulic analysis to determine required pipe sizing and friction flow factors.
- Flow testing to determine actual friction flow factors.
- Leakage survey.
- Pressure testing.
- Interior and exterior corrosion inspection.
- Recommendations regarding cleaning, relining, repairs, or replacement.

Some of the above items may not be applicable or can be quickly assessed for a particular system or problem. The guide shows a condensed step-by-step method to rehabilitate Navy water systems. The complete Engineering Guide, "Water Pipe Rehabilitation Guide," with details to accomplish each step and arrive at a cost effective solution, has been distributed to LANTNAVFACENGCOM activities.

The information contained in the complete guide should help to determine if a separate study is needed, or to select which items to include as part of the design effort. A system study can be done in-house by public works engineering, by the EFD, or by a separate contract.

The complete guide also provides information and guidance for conducting the study. Included in the complete guide is a method developed to determine the interior condition of a water pipe in the field by flow testing and computing the Hazen Williams friction "C" factor.

The most common problems which lead to water pipe rehabilitation are:

Supplement to Pipe Rehabilitation Guide

This condensed guide is a quick reference to be used as a supplement for the "Pipe Rehabilitation Guide." The arrows indicate a probable sequence of steps, and use of the condensed guide should be tailored to site specific conditions.

I. PROBLEM	STEP
Loss of Pressure	II
Red Water	II
Excessive Breaks and/or Wear	III
Excessive Leakage	II or III
Poor Maps and/or Records	IV

II. Determine Fire and Domestic Water and Pressure Needs (Present & Future)

III. Waterhammer and/or Cavitation Analysis, Leakage Survey

IV. Upgrade Maps and/or Records

V. (6) Hydraulic Analysis to Determine System Component Needs (Size & Condition) — *If Existing pipes are inadequately sized, replace unless unusual circumstances exist*

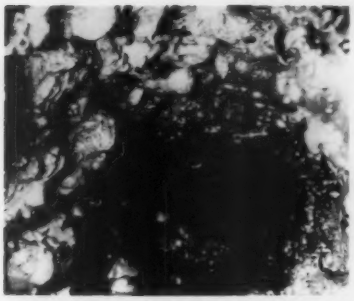
Pipe is Cement Lined and/or Calcium Buildup (+) Langelier Index		Pipe is unlined, rust tuberculation, red water, (-) Langelier Index	
Low Silica, Soft, poor pipewall bonding (Pig Lines)	**High Silica,** Hard, firm pipewall bonding (Clean*)	**Clean* and Cement Line or Low Silica** Soft, poor pipewall bonding (Pig & Treat** Water)	**High Silica** Hard, firm pipewall bonding (Clean* & Treat** Water)

**Mechanically Clean.*

***Treat to raise Langelier Index and add sodium hexametaphosphate for corrosion control.*

( ) paragraphs in "Water Pipe Rehabilitation Guide"

insufficient pipe flow capacity; excessive pipe breaks and leaks; red water problems; and a combination of the three. Where corrosive (aggressive) water exists, red water, loss of capacity, and excessive breaks are common occurrences.



A pipe interior showing the effect of corrosive water or scale-forming water in a water-distribution system without chemical treatment. The pipe is approximately 12 inches in diameter.

The rusting of the pipe interiors which causes red water, also results in flow inhibiting tubercles and a weakening of the pipe wall.

mThe picture shows rust tubercles inside a Navy eight-inch potable water line whose Hazen Williams friction "C" factor was reduced from 130 (new) to 20.

Scale forming water deposits a calcium carbonate layer on the pipe walls and protects it from rusting. Excessive deposits however, will reduce the smoothness of the pipe wall and cause excessive friction resistance to flow. More importantly, deposits will reduce the internal diameter of the pipe, resulting in a greater impediment to the flow.

Sometimes, both rusting and scaling exist in the same system due to a change in the chemical makeup of the water from location to location, or to a change in the water source or treatment. Rehabilitation can include restoring the flow capacity of existing pipes by cleaning "pigging," cleaning followed by cement-mortar lining, or pipe replacement/addition.

Copies of the complete "Water Pipe Rehabilitation Guide" of December 6, 1983, can be obtained by writing Code 114, LANTNAVFACENGCOM, Naval Station, Norfolk, VA 23511, phone (804) 444-9557. □

PLANNING:

Skills needed for excellence

By LCDR JAMES C. HAUG, CEC, USN
P.E., Calif.
Director of Shore Facilities Planning, CECOS, Port Hueneme, Calif.

"Paralysis through analysis" is a term used to describe the typical feelings of line managers toward planning, according to Thomas Peters and Robert Waterman, the co-authors of *In Search of Excellence*. The book is very critical of the planning function in an effort to pass on lessons from America's best-run companies. Planners are accused of being too concerned about employing quantitative methods without much priority for purpose, treating planning documents as ends in themselves. What can planners do to be more responsive to today's demands, and to be considered an important member of a high performance team?

I have consolidated my thoughts into four broad skill areas that may be helpful in achieving a better reputation. Prepare, listen, act, and negotiate are the four action verbs I would like to use in promoting an attitude shift; the first letter of each word just happens to spell out PLAN, which should be easy to remember.

How can planners *prepare* for excellence? It helps to be well versed in the mission and values of your activity. This concept is closely aligned with another P, for *purpose*. What is the primary reason for coming together each day? What is the message from the top which needs to be articulated well in the first part of each planning document?

The purpose of much of our planning effort is to justify to Congress the need for proposed military construction and to know key players face-to-face on their turf.

The third verb is perhaps the most real estate acquisitions. This implies a different marketing strategy than the private sector, and may explain the need to bolster, rather than diminish, the planning function.

Active *listening* skills come in handy as planners attempt to get closer to their customers. Nothing substitutes for a caring, concerned attitude based on open, informal lines of communication. I suggest adopting the practice of planning by wandering around, spending more time out of the office, getting important: *act*. Planners need to be more action oriented, rather than becoming another roadblock to execution. We learn by doing, by experimenting with suggested innovations before going system wide. Peters suggests "do it, try it, fix it" as the hallmark of innovation.

Perhaps we have noticed that the advocates of championed causes often get their way, and that people enjoy working as members of turned on teams, small chunks of groups no larger than four or five people. There remains a certain amount of risk in trying something new, but effective leaders support failure, rather than settle for the status quo.

In the future, learning to *negotiate* will be a valued skill, as more planning services are proposed for contracting out. But negotiating alternative solutions to facility deficiencies with customers, tenants, and key activity personnel is just as important.

Basically, most of the battle involves finding out what the other party really wants, and then finding ways of getting it for them.

The real problem can be parties that withhold information or who won't level with you. Defining the scope of what is desired is always the first step in any negotiated agreement.

To sum it up, planners need to become more action oriented, keep staffs lean, objectives simple and clear cut, with constant awareness of guiding values. □

Ethnic dancers & exotic hor d'oeuvres greet hundreds of guests at gala opening of CEC/Seabee Museum's new cultural memorabilia wing

RAdm Jones officiates in expansion of Navy's second oldest museum

April 30 and May 1, 1984, were auspicious days in the eyes of CEC/Seabee Museum officials at Port Hueneme — when the Navy's second oldest museum opened the doors of its new Cultural Memorabilia Wing. In the planning stages since 1978 and construction stages since 1980, the Navy hosted several hundred curious invited guests over the two nights who came to witness the official ribbon-cutting ceremony.

Guest of honor presiding over the ribbon-cutting ceremony on April 30 was RAdm. John Paul Jones, Jr., CEC, USN, Vice Commander and Deputy Chief of Civil Engineers, assisted by Museum Director Hark Ketels. Guests included invited senior officers of the Center and of nearby stations and several officers' classes from the Naval School, Civil Engineer Corps Officers, as well as the school's staff.

On May 1, Capt. John A. Westcott, Commanding Officer of the Center, did the ribbon-cutting honors. Guests that night included invited local leaders and civilian personnel from the Center.

Guests on both nights were treated to a gala evening with special oriental hors d'oeuvres representing several cultures, and served by strolling oriental ladies in native costumes, and to entertainment by a professional group known as the Aloha Islanders. The group entertained with a 40-minute presentation of music and ethnic dancing from the South Pacific. More than 250 guests were counted on both nights.

The Cultural Memorabilia Wing contains thousands of artifacts from throughout the world, but mainly from the Pacific area and orient. Many of the artifacts were donated by Seabees who received them from native peoples in appreciation for work accomplished such as roads, bridges, airfields and other projects to help the native population.

According to Museum staff members, credit for spearheading the efforts to construct the new wing must go to one man — Mr. Hark Ketels, Museum Director, whose persistence and encouragement was the principal impetus that led to the wing's completion. Ketels is quick to state, however, that the entire Museum staff "pitched in 110%" to complete the project. A devoted Seabee whose career began at the seaman level in 1947 and rose up through the ranks to the rank of lieutenant commander before he retired in 1972, Ketels is a "walking encyclopedia" on Navy and Seabee memorabilia. He is often a guest speaker on the subject for groups of military and civilian audiences both on and off the Center.

Standing out conspicuously in this story is the fact that the new wing was built without taxpayer's dollars. In this day of high government spending, this is a rare accomplishment. The new wing was funded from profits generated by the Museum's Gift Shop headed by manager Loretta Cavanaugh; all materials were purchased with these funds. While the outer shell was constructed by Seabees, the interior was completed by the Museum's

On hand to witness the official ribbon-cutting opening the new Seabee Cultural Memorabilia Wing by RAdm. John Paul Jones are (from left, and mostly Museum staff members): Ms. Diane — Mail Order Specialist; Margaret Dallwig — Registrar; Robert Borie — Exhibit Specialist; LCdr. Hark Ketels (ret) — Museum Director; RAdm. Jones; Capt. John A. Westcott, Commanding Officer of CBC; Loretta Cavanaugh — Office/Gift Shop Manager; and Andrea King — Assistant Manager.

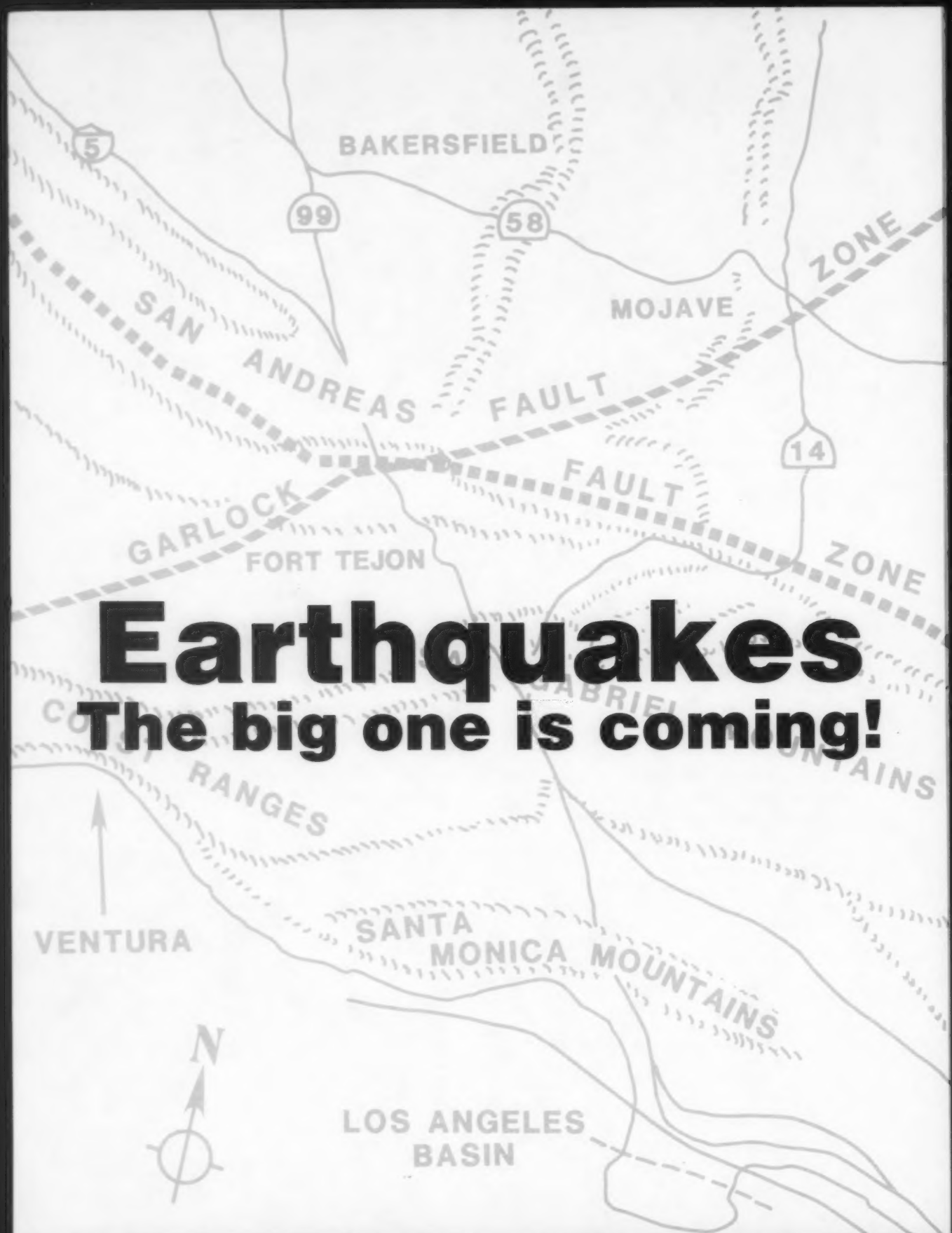
Five ladies in ethnic dress served foods from many lands to strolling guests at the Museum's wing opening.

Performing a native dance for Museum guests are Mrs. and Mr. Wallace Walea II, leaders of the entertainment group, the Aloha Islanders.

small staff including wallpapering, painting, decorating and all the rest. The Seabees' involvement was actually used in homeport projects — intended to teach new skills and maintain old ones.

The museum is always on the look-out for new artifacts and will accept donations. They should be connected, however, with the Seabees or the Civil Engineer Corps. The museum is also open to the public on most days of the year. For information about donations or visitations, call (805) 982-5163 or Autovon 360-5163. □

Four members of the Aloha Islanders dance group entertain Museum guests with a special routine.



Earthquakes

The big one is coming!

New codes make seismic activity safer

The big one is coming! When living in areas such as the West Coast of the United States, the Mediterranean, and the Far East, it is not a case of *whether* a major seismic disturbance will occur but *when* it will occur and how much damage it will do.

The conditions which exist in areas of active seismic activity should be of interest to architects, civil engineers, and other construction professionals.

By JOHN M. BUFFALO, PHI, USNR
Geologist and Assistant PAO
RNMCB-16, Los Alamitos, Calif.

It is important to consider seismic activity, how it affects us, what this type of activity does to man-made structures, and to look at a number of ways in which construction professionals may limit the damage and destruction caused by major seismic movements. Then, several conclusions will be presented regarding the relationship between major seismic activity and good design, engineering, and construction practices.

The examples used will be primarily located in the Western United States with principal emphasis on the activity occurring in California. The use of California is deliberate as it is one of the best documented and thoroughly studied areas of seismic activity on the globe.

EARTHQUAKES — WHAT AND WHERE

Earthquakes may be defined as being any movement within the crustal portion of the earth's structure, which may or may not have any surface features related to it. The potential for seismic activity is possible in any portion of the globe which has undergone any phase of mountain building. This is especially apparent in California where there are many young mountain ranges and one of the longest and thoroughly studied fault systems known to man.

Types of Major Faulting

Thrust or Normal Faulting — The faults of this type are in existence where the seismic energy generated causes a great deal of vertical displacement. As is shown in Figure 1, the bedding along face A is pushed, or thrust, over the bedding along face B. In actuality the rupture, though quite visible, is often extremely distorted by the movement occurring along the faces prior to the actual point of rupture. The displacement along the fault plane in this type of fault may vary from several inches to as much as 20 feet depending upon the stability of the soil and the type of rock faces.

Reverse Faulting — This is also a type of fault where there is great vertical displacement occurring, but as the name states, the direction of movement is along the base plate rather than along the top plate. This type of movement is shown in Figure 2, where plate B is forced up and over plate A. The displacement and distortion in this type of faulting is similar to that which occurs in normal faulting, only the orientation differs.

Lateral Faulting — Lateral faults are seismic ruptures where movement occurs along a horizontal plane rather than along a vertical one. The movement may be considered to be either right-lateral or left-lateral; examples of this are the San Andreas which is a right-lateral and the Garlock which is a left-lateral. There may, however, be some supplemental vertical movement caused by adjacent faulting and/or from the settlement of unconsolidated strata. Figure 3 shows a right-lateral fault and Figure 4 shows a left-lateral fault. Traces of lateral faulting are shown through the distortion of surface features such as roads and streams.

Combination Faulting — This type of faulting is the author's name for that type of faulting which occurs at the crossing or junction of two major fault systems of different orientation; where there is much movement of various types and a great deal of surface distortion, thereby increasing the potential for great damage. The most severe recorded quake in California history occurred at Ft. Tejon in 1857 with a magnitude of 8.3 and the epicenter was located at the junction of the Garlock and San Andreas systems (Figure 5).

Faults and Faulting — It must be remembered that all of the world's major fault systems are made up of numerous smaller ruptures, which, by their close proximity and orientation, have significant effect on each other. An excellent example of this is the San Andreas which is made up of thousands of smaller faults ranging in length from a few feet to 50 miles.

When closely related faults are mapped they are usually given a single name as occurs with the San Andreas system. While the cities of Calexico and San Francisco rest upon the San Andreas system, this multiple fracturing is why movement centered near one site, such as occurred in Calexico in 1980, may not be felt at the other site.

Location of Major Seismic Activity Worldwide

The majority of major seismic activity worldwide occurs in well defined belts of mountain growth. An example of this is the "Pacific Ring of Fire" which includes such major quake zones as Japan, Alaska, and the West Coast of the United States. Other minor faulting does, however, exist in other areas of minor mountain building or isolated volcanic activity.

Unfortunately for man, and especially for the architects who must design and build man's structures, he has found the foothills and plains to be his favorite habitats. This is shown in the fact that such major metropolitan areas such as Los Angeles, San Francisco, and Tokyo are either built on or in close proximity to major zones of faulting.

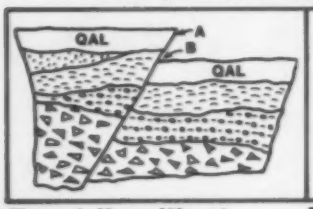


Figure 1. Normal/thrust faulting.

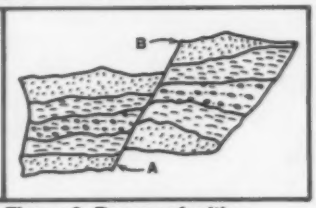


Figure 2. Reverse faulting.

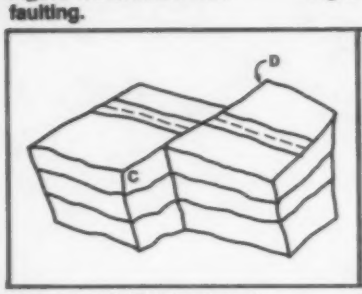


Figure 3. Right lateral fault.

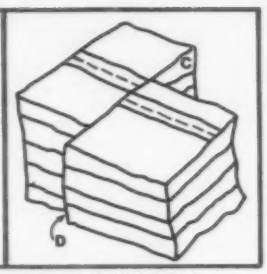


Figure 4. Left lateral fault.

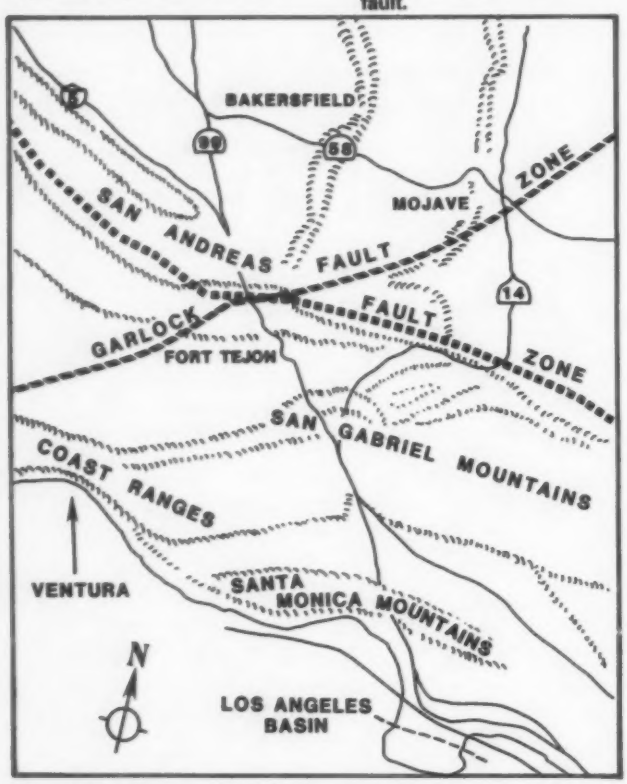


Figure 5. Garlock and San Andreas systems.

A common site of seismic activity is in the areas of active geothermal or volcanic activity. This is shown in the large number of quake swarms which occurred during the ejective phase of the last erruption of the very active Mount Saint Helens in Oregon and in the geothermically active area surrounding Mammoth Lakes, Calif., also in 1980.

SEISMIC ACTIVITY AND MAN

The studying of seismic activity and the magnification of results of seismic damage has increased significantly as man's involvement has increased. There are certain types of techniques and construction materials which become highly suspect in areas of extreme seismic activity.

High Damage Earthquakes — How and Why?

Yearly, there are a number of earthquakes felt worldwide. These movements have a magnitude of 2.5 on the Richter Scale or higher (Figure 6). It also must be understood that a difference in magnitude on the Richter Scale, such as from 5 to 8, is not single unit change in energy but a change in energy output of 100 times.

The energy magnitude of a quake is not necessarily a valid determination of the damage which can be caused. The damages are better defined in the Modified Mercalli (MM) scale (Figure 7).

To better explain this phenomenon in early 1983, two major quakes occurred but the damage figures varied greatly. In North Yemen a 6.0 quake caused major structural damage and took over 2,800 lives, whereas a larger 7.8 quake in the Solomon Islands caused relatively little damage and no loss of life.

Severe damage often occurs from over-building and improper building, overcrowding, extreme changes in ground water, and a lack of knowledge or responsibility of the region's geologic or seismic conditions. It is imperative that building professionals first have a geologic/seismic report done prior to site selection, and use the report conscientiously when making the site decisions.

Richter Logarithmic Scale of Seismic Intensity — The scale in Figure 6 was designed to express the intensity of movement that is released during seismic activity. It is based upon the mathematical relationship of factors used in the Rossi-Forel scale.

The descriptions are highly empirical and are not a precise description of intensity. The log measurement is based upon the formula $\log a = I/3\text{-}1/2$ with I being the intensity number on the Modified Mercalli Scale and a is acceleration in cm/sec^2. The logarithmic figures for intensity do hold true when reassigned to the Modified Mercalli Scale of Seismic Magnitude. Also, and most important, each log on the scale represents an increase of the energy emitted during the disturbance by a factor of 10.

Modified Mercalli Scale of Seismic Magnitude — The logarithmic scale of intensity formulated by Charles Richter and Beno Gutenberg, when applied to the Modified Mercalli Scale of Seismic Magnitude, established a relatively accurate description of the energy released during seismic activity. Since the criteria of each seismic disturbance differs with its locale and environmental considerations, some of the descriptions are to be ignored when evidence shows a conflict. The numerical scale on this scale is increased to 12 to

give a more thorough explanation of what is occurring.

Anyone using this and the previous scale should remember to use the whole combined form with the Mercalli descriptions and Richter Intensity logarithm when explaining magnitude and damage occurring.

Primary Causes of Structural Damage

The majority of damage which is reported after seismic activity is found to be in man-made structures. Usually this damage is related to either the primary construction techniques or the materials which were used in the construction of those structures.

A primary cause of quake damage in older buildings is from the use of nonreinforced concrete or masonry which is unable to withstand the tortionary stresses caused by horizontal forces exerted during the tremor. The use of brick or stone facades is also suspect due to inability to withstand the stresses which cause basal shear (Figure 8). An example of this kind of damage occurred in Coalinga, Calif., in May of 1983.

Dam Construction and Damage

Dam construction is usually discussed separately when seismic activity is discussed because of the numerous types of dams, varied sites, materials which are used for construction, and the fact that this type of construction is extremely vulnerable to damage during seismic activity.

Of all dam construction, the type which has proved to be the most vulnerable of all is the earthen fill. This type has proven itself to have extreme difficulty in coping with soil liquefaction, settlement, and basal shear forces which occur during severe seismic activity.

INTENSITY	ROSSI-FOREL DESCRIPTION OF INTENSITY
1.0-1.99	**Microseismic Shock** — Recorded by a single seismograph or by seismographs of the same model but not of differing models. Felt only by experienced observers.
2.0-2.99	**Extremely Feeble Shock** — Recorded by seismographs of all types, and felt by a few persons at rest.
3.0-3.99	**Very Feeble Shock** — Felt by several persons at rest; strong enough for the direction or duration to be appreciable.
4.0-4.99	**Feeble Shock** — Felt by persons in motion; disturbance of movable items, doors, windows; cracking of ceilings.
5.0-5.99	**Shock of Moderate Intensity** — Felt generally by everyone; disturbance of furniture, beds, etc.; ringing of some bells.
6.0-6.99	**Fairly Strong Shock** — General awakening of those asleep; general ringing of bells; oscillation of chandeliers; stopping of clocks; visible agitation of trees and shrubs; some startled persons leaving their homes.
7.0-7.99	**Strong Shock** — Overthrow of movable objects; fall of plaster; ringing of bells; general panic; without damage to buildings.
8.0-8.99	**Very Strong Shock** — Fall of chimneys; cracks in some buildings.
9.0-9.99	**Extremely Strong Shock** — Partial or total destruction of some buildings.
10.00	**Shock of Extreme Intensity** — Great disaster; ruins; disturbance of the strata, fissures in the ground, rock falls in the mountains.

Figure 6. Richter Logarithmic Scale of Seismic Intensity

On May 2, 1983, an earthquake destroyed most of the buildings within a six-block area in Downtown Coalinga, Calif. Typical damage is shown in two views.

Not only is this type of construction generally suspect in seismically active areas, but in older structures of this type there was quite often little or no pre-construction site examination to ascertain the stability of underlying strata. Demonstration of the site stability could possibly have prevented some of history's most infamous dam failures (Figure 9).

Some of the newer structures of this type and some of the older ones as well have been lined with asphalt or concrete. The same problems again occur when, due to motion-caused tremors, the lining becomes cracked. Sechies, extreme erosionary processes, and hydrostatic pressures above the design limits of the structure involved, have either caused complete destruction of the structure or caused damages severe enough to render the structure unusable (Figure 10).

Vivid examples of this have occurred at the San Francisquito Dam near Santa Paula, Calif., and the Teton Dam in Idaho where the structures actually failed and the Lower Van Norman Dam in Sylmar, Calif., which was badly damaged during the 1971 quake to be deemed unrepairable.

Curved masonry and compartmentalized reinforced concrete dams have proved to be the best for their ability to absorb stresses which occur during seismic activity (Figures 11 & 12). Hoover Dam, Shasta Dam, Roosevelt Dam, and others of this type, have used either type of construction with the type being based upon proper geologic/seismic planning done prior to construction. These dams were constructed to use the energy forces to actually make them stronger rather than weaken them.

Occasionally, however, a dam of this type will fail due to sechie action. Sechies are high energy, seismically gener-

ated waves which can cause great surface structural damage and total failure when the hydrostatic pressures coupled with the energy generated exceed the design limits of the structure.

INTENSITY	DESCRIPTION
I	Not felt except by a very few persons under especially favorable conditions.
II	Felt by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings but many persons do not recognize it as an earthquake. Standing cars may rock slightly. Vibration like a passing truck. Duration is only estimated.
IV	During the day felt indoors by many, outdoors by a few. At night some awakened. Dishes, windows, doors, disturbed; walls make a cracking sound. Sensation like a heavy truck striking a building. Standing vehicles rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows, etc. are broken; a few instances of plaster cracked; unstable objects are overturned. Disturbance of poles, trees, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all; many persons frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimney. Damages slight.
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well built ordinary structures; considerable in poorly built or badly designed structure; some chimneys broken. Noticed by persons driving vehicles.
VIII	Damage slight in specially built structures; considerable and with partial collapse in ordinary substantial buildings; Great in poorly built structure. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well waters. Disturbs persons driving motor vehicles.
IX	Damage considerable in specially designed structures; well designed frame structures are thrown out of plumb; great damage in substantial buildings, with partial collapse. Buildings are shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in the ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown into air.

Figure 7. Modified Mercalli Scale of Seismic Magnitude

Supplemental Causes of Seismic Related Damage

Tsunamis — This is the Japanese word for fast-moving, extreme-energy-generated fluid waves, generally caused by seismic or volcanic activity. By their very nature they are transitory, but the energy generated is immense. The energy is more greatly magnified as it comes in contact with shallower water.

The potential for damage in coastal areas is extremely high in those areas of large population. The destructive nature of this type of wave is shown in the 1896 tsunami which struck Japan and was responsible for the loss of over 27,000 lives and 10,000+ structures.

Landsliding and Slumping

A regular occurrence during and just after seismic activity is the motion initiated rock fall or slide. Rock falls and soil slump types of landslides usually involve the unscheduled movement of great volumes of material. The potential of damage and loss of life is great, coming from either the slide itself or from a sechie generated by the slide when it hits a stream or lake (Figure 14).

A disastrous example of this occurred in the Madison River Canyon of Southern Montana in July of 1960 when a moderately severe tremor along the Red Canyon Fault caused a slide to fall into the river in a resort area during its busiest season. This specific slide involved many millions of cubic yards of material, caused $4,300,000 in damage to roads and structures and cost 28 persons their lives.

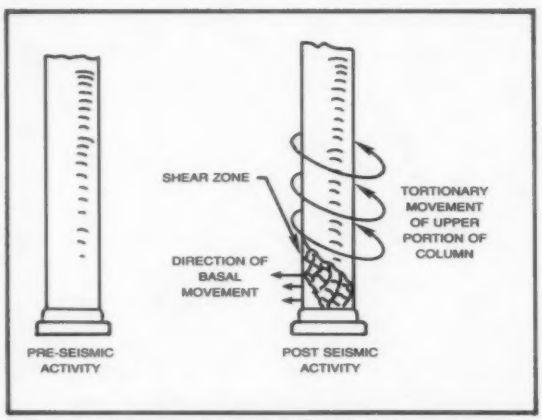


Figure 8. Tortion damage and basal shear caused by major seismic activity.

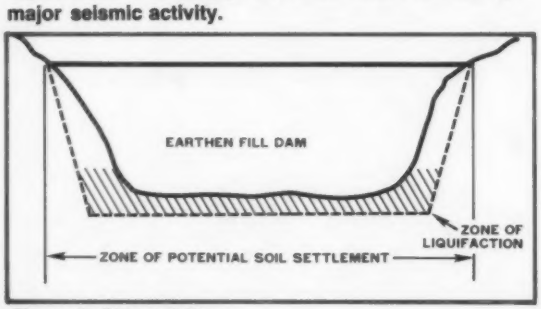


Figure 9. Site stability.

Fissuring

Fissuring is a problem which appears when surface faulting occurs or subsurface seismic activity is so massive that the ground is actually ruptured in numerous places. This is not to be confused with scarping which is the face of the fault plane which has been raised in vertical faulting. In most cases the fissures are numerous and small, but occasionally massive fissuring occurs as happened in the 1906 San Francisco and 1960 Montana earthquakes.

Distortion of Surface Features

During severe seismic disturbances, especially where there is surface movement or rupturing, there is a great deal of distortion in man-made features. Usually the most severe distortion occurs to those structures which lie adjacent or across the fault plane. Where there is vertical displacement, structures will be vertically ruptured or distorted. In lateral faulting some of the distortion will be vertical, but most of it is in the direction of movement with the most obvious results being the offsetting of stream courses, roads, railroad tracks and fences. Not only is the cost great in terms of actual structural damage but also in the supplemental disruption of transportation and utility services.

A well-documented example of this occurred in 1952 when the Southern Pacific Railroad and California Highway 58 were extensively distorted and damaged by movement along the White Wolf Fault.

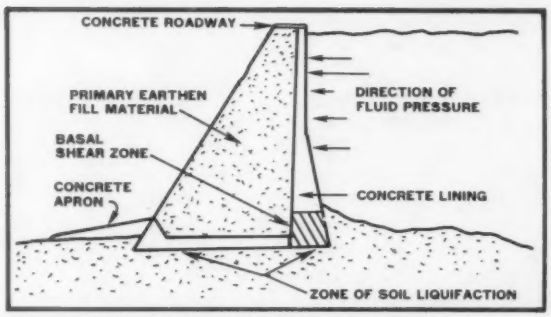


Figure 10. Dam construction and pressures.

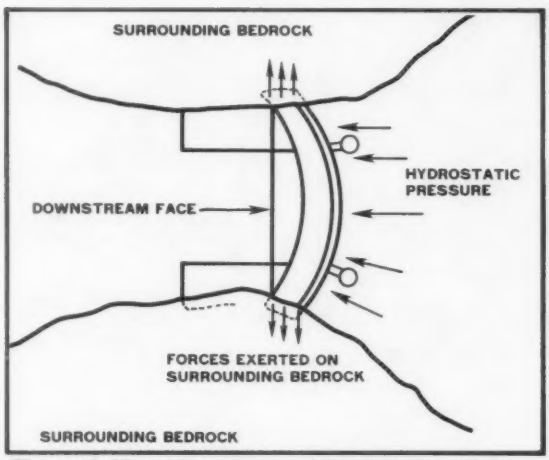
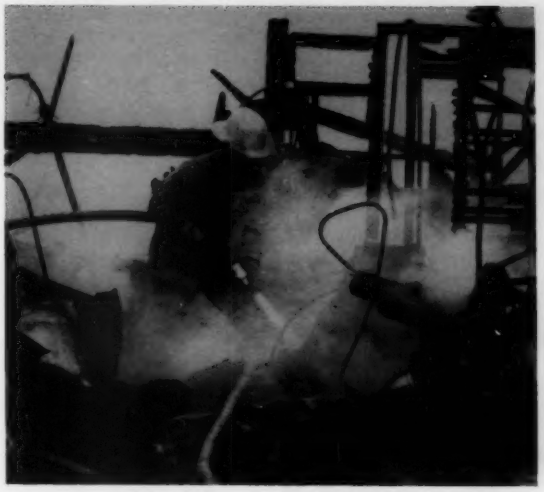


Figure 11. View of compartmentalized construction.



A fireman extinguishes burning rubble following a 6.5 (Richter Scale) earthquake in Coalinga, Calif.

DAMAGE PREVENTION IN STRUCTURES

Complete prevention of damage to all structures in an area during an earthquake of high magnitude is impossible, but it is critical for all persons to be aware of problems which can occur during seismic activity and how to react to them. Architects and project engineers must be aware of conditions, legal codes to prevent (or limit) damage, and some of the things which can be done to insure that new structures meet or exceed requirements for quake resistance and older structures are brought up to minimum standards.

Legal Statutes

Until 1906 there were virtually no statutes regarding seismic safety. After the 1906 disaster in San Francisco, a few local regulations appeared. The 1933 Long Beach, Calif., quake settled things and the Field Act, the nation's first comprehensive set of seismic regulations, was passed soon after with an emphasis on schools and public buildings.

Things remained relatively static until 1971 when the massive Sylmar quake occurred. After this quake, when relatively new structures were destroyed, the seismic codes were severely upgraded to include all new structures, and all older commercial and public structures.

SEAOC as the new codes are known, were instituted to insure that new technology and seismic studies were made before commercial and public structures were built. Certain public structures such as schools are even more stringently regulated under Title 21 of the California State Administrative Codes, primarily to effect the safety of our children.

Methods for Strengthening Structures

There are many techniques for strengthening structures in a seismic area. A few of the major ones are presented. In California, it is important to discuss strengthening because there are many pre-1933 structures still in existence.

There are ways to strengthen walls and facades to increase their stability. Regular lime mortar will not fold a facade

during a severe earth tremor even if secured with staybolts due to the brittleness of the mortar.

An easy way to strengthen this construction is to shoot Gunite, a pressurized liquid concrete, behind the brick or stone of the facade completely filling all voids and making the structure more stable (Figure 15).

An even stronger method of shoring up the facades is to install rebar behind the facade in conjunction with the staybolts so there is more for the Gunite to bond to.

On new construction or complete rebuilds it is important that the diaphragm of the structure be considered as it can greatly affect the stability of the structure. The diaphragm is the combination of structural elements which are on the horizontal plane and are responsible for tying the structural elements together.

In order to insure resistance to quake damage it is necessary for the structural engineer to insure that the diaphragm is either extremely rigid or very flexible, but not somewhere in between. If the diaphragm is rigid then the vertical elements of the structure must be flexible. This is because if the diaphragm and the vertical members have the same degree of flexibility then there are serious load distribution problems and a high risk of rotational damage and basal shear.

The best type of diaphragm has a steel reinforced concrete construction with a flexible steel superstructure that is able to withstand great stress factors. The stability of diaphragms markedly decreases as the construction materials progress from concrete to wood, with wooden diaphragms having the greatest risk of basal shear and rotational damage.

Briefly mentioned previously, the use of pre-construction seismic/geologic studies can be invaluable to the architect or project engineer in establishing the criteria for a building. By knowing the seismic conditions of a site prior to building, it is then possible to design in factors which are reasonable without driving the costs of construction out of sight.

Probably the best known example of seismic evaluation prior to construction is in the case of the Auburn Dam in Northern California. Thousands of core samples and trenches have been examined to insure that all seismic conditions which might possibly affect the dam are known.

No matter what techniques are suggested or studies made, if the architect and the project engineer are unwilling to include the seismic information into the design specifications for the structure then the structure will be suspect during major seismic disturbances. Seismic safety is not one of the areas which can be short cut when allocating design or construction funding.

Prediction of Seismic Activity

To use advance prediction of tremors to insure seismic safety is to ask for trouble. At present there is no completely foolproof method for pre-determining a quake or its magnitude; efforts today run the gamut from folk-art to highly technical scientific studies. There is nothing conclusive so all forms of prediction must be considered.

Some studies at present are being done into the behavior of lower animals to determine if they are able to instinctively predict tremors. Most of this work has been done in the Peoples Republic of China. At present the United States Geological Survey (USGS) is extensively mapping and surveying all major fault systems nationwide and assisting foreign governments in their studies of seismic activity.

The California Department of Resources is working in conjunction with the USGS to constantly monitor all elastic and groundwater movement. These two movements seem to be the best scientific indicators of seismic activity prior to its

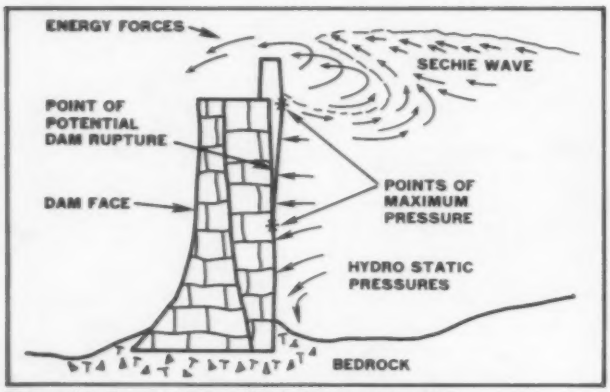


Figure 12. Compartmentalized dam construction.

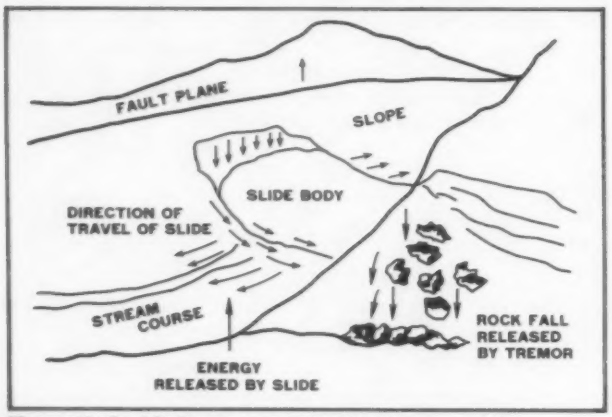


Figure 13. Sechie forces and potential damage points.

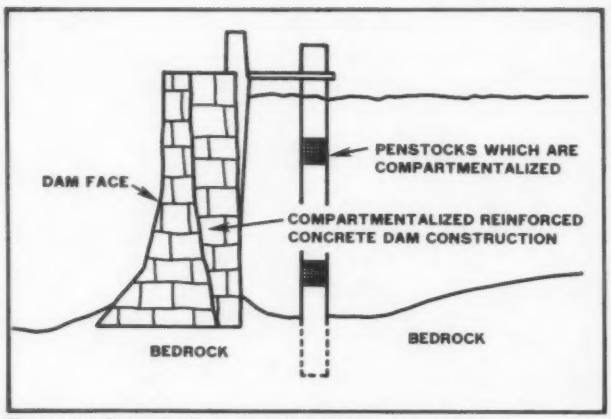


Figure 14. Seismically generated slides and rock falls.

occurrence. Instrument studies at certain known stress points have determined actual elasticity of strata. Laser accelerographs are triggered by strong motion and are planted in areas of known seismic activity.

Historical Studies

Knowledge of the past activity of an area when choosing a site can be of benefit to the project engineer so that he might be aware of ancient faults, landslides, and other such structures which may affect any building through changes in ground water. This allows the project engineer to also avoid any active hazards in the area or to change the site altogether.

Military Applications

It is important that the military civil engineer be aware of the seismic factors which are in evidence when on an assignment. In a tactical situation there might not be a need to look at seismic conditions, but in a strategic or public works capacity it does become important.

Due to the preponderance of regulations in the United States the civil engineer must do thorough background study when assigned to major projects such as dams or nuclear facilities.

The Navy civil engineer is also called upon when deployed overseas to act as liaison between the Navy and foreign nationals in the mutual aid program. It is up to professionals to pass on the information learned so that the number of persons killed or injured will be greatly reduced, and the structures built will be quake resistant.

It is also important for the Navy civil engineer to be aware of action that must be taken regarding seismic disturbances in a disaster recovery role. Officers and men should understand seismic activity and to also know how to react to post tremor conditions.

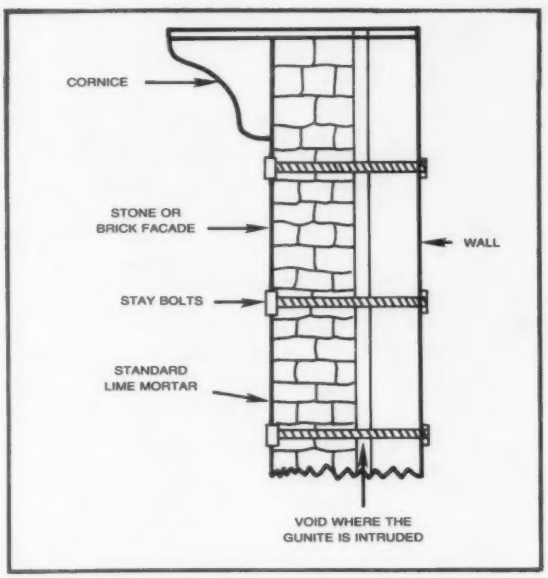


Figure 15. Gunite intrusion into the voids between the facade and wall of a building to increase the quake resistance of the facade.

When a disaster occurs the military, just by its proximity, will be called on to assist the civilian population in the United States.

This was the case in May of 1983, when Coalinga, Calif., which is 36 miles from Lemoore Naval Air Station, was hit with a devastating 6.2 quake. Naval units here were called in to give assistance in the cleanup as well as performing security and medical functions.

Overseas locales are not usually as fortunate. If not for the U.S. military, they would have greater disasters. Quite often, local operations overseas would completely cease without the assistance of the United States and its military services.

SUMMARY AND CONCLUSIONS

Yes, the big one is coming. We have considered different types of seismic activity, damages that can result and some of the things that can be done to avoid major destruction and heavy loss of life. Detailed looks were also made at man and his relationship to seismic activity with an emphasis on the Western Coast of the United States, legal statutes and some of the methods from which we predict quakes.

With it being a fact that major seismic activity will occur with regularity in areas of mountain building, it is necessary to draw a number of conclusions regarding seismic safety and the role of the construction professional.

It is imperative that the architect or project supervisor be familiar with a site prior to construction as seismic conditions may cause alteration in design specifications of a structure. The construction professional must also make use of seismic/geologic reports when they are completed to thoroughly understand the site with which he must work. This also includes noting whether a site will be able to have expansion possibilities or whether seismic conditions will limit the size and capacity of a structure. Understanding local codes is also another area where the construction professional needs to have a working familiarity.

After the site is chosen, if in an area of seismic activity, the project engineer must then understand that a major seismic disturbance while being inevitable cannot be predicted with any scientific accuracy and that any structure should exceed seismic minimums in design. Since even the best designed structure is no better than the materials used, the project engineer must use quality materials and techniques during the construction process.

Finally, the Navy civil engineer may be called upon to teach foreign nationals in seismic resistant techniques or may have to assist in disaster recovery operations after a major seismic disturbance. Understanding of seismic activity will help the civil engineering officer and senior enlisted personnel in establishing a proper sequence of operations while insuring security and medical assistance can be granted to the affected site.

It is critical for all construction professionals, architects, civil engineers, geologists, and those who must actually build structures, to understand seismic activity. We must not only understand its processes but how to deal with its results. If we do this the damages which occur during a major seismic disturbance and its attendant injury and loss of life figures can be reduced significantly. As professionals it is up to us to build a structure which is properly designed, planned, built correctly, and is above all a **safe** one. □

reader's comments/questions

departments

Detailers try to assign spouses together

I've been receiving the issues of *Navy Civil Engineer* for almost two years now and I would like to commend the quality of the magazine articles. The technical topics covered have been enlightening, but the most enjoyable ones to read have undoubtedly been the human interest stories.

The CEC community is fairly small in size, numbering approximately 1500 officers. In my short career in the Navy thus far, I've already met quite a few of the other CEC officers. There are still others, however, who I may never get an opportunity to meet and by contributing their stories in the *Navy Civil Engineer*, I feel as if I've at least had a chance to share a small part of their lives. As an ensign only a few months out of CECOS, I consider myself lucky to be able to read about how the other CEC officers are doing and how they've survived in the past.

As a personal point of interest, I would like to recommend that a human interest story be surveyed and written concerning bi-spousal CEC officers. I am presently involved with a male CEC officer and we're planning to get married in about a year or so. It would be enlightening to me to see how other CEC officers married to another CEC officer have managed to handle their professional and personal lives. I am also interested in finding out if any special provisions for detailing spouses have been made in the past to ensure tours of duty in the same general location.

Ensign Paz B. Gomez, CEC, USNR

Your question has been asked before, Paz, and I am happy to write that detailers DO work very hard to place spouses in the same general area. It is wise, however, to let them know your desires as soon as possible. Inform your detailer of your scheduled marriage so plans can be made. That way, you won't have to wait through your present assignment first.

Paz, YOUR case sounds like a typical one. Why don't YOU write an article describing your experience and recommendation and/or findings? We'd be happy to accept it! Perhaps other readers will accept the invitation also. In any case, see the letter that follows.

Spouses ask: For better or worse?

If it is 0300 Monday, and we are awake, it must be McGuire Air Force Base in the middle of nowhere in New Jersey. International Jet Setters? Yes, I suppose you could call it that. We have traveled to and from Argentina, Newfoundland (Canada), and Washington, D.C., several times in the past year with occasional stops in Thule (Greenland), Goose Bay Labrador (Canada), Montreal (Canada), and Boston, Massachusetts. Although the glamour of first class travel did not accompany our trips, we arrived at our ultimate destinations exhausted after several hours of sitting in C-141s or racing around in airports; but always in one piece and always ready to go one more time. Each trip was necessary and more than worth it.

We are one of the few sets of married naval officers, both in the Civil Engineer Corps. Thanks to the Navy and the CEC, we met at CECOS Basic in January 1983, Port Hueneme, California; separated in March 1983 to go to our respective duty stations; and were finally able to be married in November 1983. After what will be a total of 16 months and several conversations with the CEC Detail Office, we can finally look forward to being stationed together in June 1984.

Is it for better or worse? We both took the same two separate oaths; one to . . . "love, honor, and cherish each other as long as we both shall live," and the other to ". . . support and defend the Constitution of the United States, against all enemies, foreign and domestic . . . Can both be done? At the same time? Absolutely!

Both of us are United States Naval officers, engineers, and professionals. We share a certain companionship and understanding of the Navy system that many officers never have. We are engineers with different specialties: one with a mechanical engineering degree; the other in civil engineering. Instead of competing against each other, we complement each other. Our engineering careers are enhanced and broadened by the other's willingness to share particular knowledge and technical skills. We are able to communicate and share the daily details of each other's jobs with an understanding and caring that many married people don't have or are even able to imagine. As professionals, we strive for excellence and personal satisfaction from our jobs. Each provides encouragement and support to the other on both a personal and professional level.

Although the personal rewards due to being CEC officers are many, there are several system drawbacks. The separations are destructive. The "better half" is not always there to provide the daily support and encouragement that is so vital for personal and professional growth, not to mention emotional stability. Currently, it appears, the CEC detail policy is not to assign husband-wife teams to small naval facilities. We are therefore limited, as CEC officers, to living and working in larger cities where there are several different commands with a large variety of billets available.

The number of women officers in the CEC is growing. This opens the possibility of a larger number of CEC officer husband and wife teams. The policies directing the detailing process should be examined to allow maximum job opportunities with no family separation. There is a solution. Granted, each case should be examined separately, but without re-evaluating and changing the current policies, long term retention may suffer.

As for the two of us, our initial struggle is coming to a close. Some battles may have been lost, but we lasted out the war. After all the hours on the phone, the few, long-traveled, brief "honeymoon" weekends together, and many *long* months alone, we are looking forward to our time together. Mr. and Mrs., or is it Lieutenant and Ensign? It doesn't matter. For better or worse, we will be together. *Finally*!

Michael and Paula Freemyers

Thank you for sharing your experience. It introduces a subject that may be of interest to others in the same situation or about to be. I contacted Cdr. Dave Schlesinger, a detailer in Washington, D. C., and he provided this answer:

Detailing policies for married couples

The number of female officers in the Civil Engineer Corps has grown significantly in the past three years. The NAVFAC Deputy Commander for Manpower and Organization conducted an extensive study in 1983 to determine what accession polices should be follwed in achieving continued growth of women engineers and architects in the Corps.

The major parameters considered were: total population of women in the Navy-wide Officer Corps; number of women graduates from Accredited Engineering and Architecture Schools; billets in the Civil Engineer Corps available to women.

Women constituted 8.30% of the total Navy Officer Corps at the end of 1983. Interestingly the percentage of women graduates from engineering curricula accredited by the ABET (Accreditation Board of Engineering Technology) and from architectural Accrediting Board was approximately 8.0% also.

The total number of billets available to women in the CEC is 92%. Based upon an expanded corps size of 1800 officers (currently in the approved billet file 1792 billets have been identified) it was determined that a Corps strength of 144 women was optimal. Current accession plans call for the 144 goal to be reached in FY88. As of this date there are 78 women on active duty in the Corps. This contrasts with only 18 on board as recently as October 1980.

With the rapid growth of women in the Corps the probability of larger numbers of CEC officer husband-wife teams is a distinct possibility. There are currently 57 military couples with the husband or wife in the Civil Engineer Corps. They include Supply corps, JAG Corps, Nurse Corps, Cryptology, Engineering Duty Officer, Medical Services Corps, Line, Submarine, Aviation, Marine Corps and even the U.S. Army! The combinations are growing as fast as the numbers of military couples. There are seven couples who are CEC-CEC.

As one might imagine the Detailing Process-which currently attempts to satisfy the needs of the Navy, Qualifications of the officer and aspirations of the officer's further complicated by the addition of another officer career requirements in the move process. The Naval Military Personnel Command has issued policy guidance to detailers in the case of military couple assignment policy.

The general policy is that detailers will make every effort to allow military couples to move together and serve together whenever possible in the same manner as non-military couples. The military couple assignment policy approved by CNO authorizes these moves as cost moves-in other words if specific criteria is met the government will fund the PCS move even if the members are not collocated at the time of request provided specific details are met.

The details of the military couple assignment policy are as follows:

- Military couples desiring collocated assigment will submit new duty perferences separately, noting their military couple status, spouse's name, SSN, year group and present duty station.
- Members not presently collocated can request reassignment in accordance with MILPERSMAN 1820340 provided the following criteria can be satisfied:
  - — Members are married at the time of request. Exceptions may be granted in those rare cases when a couple who is engaged to be married is assigned to a command where marriage is discouraged (i.e. Diego Garcia) and the couple desires collocation on their follow-on tour. Request for collocation under these circumstances must be endorsed by the CO.
- Requesting member must have completed one year on board current duty station.
- Authorized billet for which he or she is qualified is available.
- If required a contact relief is available.
- Request for PRD adjustment should be received at least six months prior to transfer.
- When marriage occurs within three months of transfer or after orders are executed, orders remain in effect unitl eligible for reassignment as discussed above.
- Detailers will make PRD adjustments for each member whenever possible to carry out above policy.
- When possible, matching PRD's will be established to facilitate collocation in future assignments.
- In the case of instances where both husband and wife are CEC officers it is policy to assign the couple to large Naval complexes in CONUS or overseas where several different naval activities are located in lieu of assigning both couples within the same command.

Because the Civil Engineer Corps is a relatively small community and the Detailers are able to maintain close contact with their constituents, any member of the Corps who is contemplating marriage to another military member should contact his/her detailer at an early date.

All new Ensigns receive a personal interview from the Detailer before graduation from Newport, RI, USNA or NROTC to discuss their initial assignment and begin the dialogue with their detailer that should continue throughout their naval careers.

The CEC Detailers literally cover the word on their visits on an annual basis so each officer should have the opportunity for a face to face interview. The preference card and the telephone remains the other primary methods of communication so keep those cards and calls coming.

Cdr. F. D. Schlesinger
CEC, USN, Senior Detailer

New concept may solve old problem of poor planning

By RON D. YEATER
P. E., ILL.
Director, Installations Planning Division
AND
STEVEN J. ARMENIA
P. E., Pa.
Engineer, Design Division

Project submittals at the Northern Division of the Naval Facilities Engineering Command have been received repeatedly which do not adequately define project requirements or existing site conditions. Disclosure of this fact about the projects, which are both Military Construction Navy (MCON) and Military Construction Navy Reserves (MCNR), is made during the project engineering documentation (PED) development stage of the design process.

In addition, projects which had been authorized for design and frequently did not have the benefit of detailed planning relative to infrastructure requirements such as the ability of existing utility systems to support the project.

There were also instances of projects where logistics, supply or transportation requirements were not adequately defined, e.g., coal for boiler plant conversion to be transported by truck, rail or barge. Incidents of training buildings needing major changes at an advanced design stage because second iteration equipment characteristics and support requirements were not adequately defined has also been experienced.

The late submittal or non-submittal of required programming documentation also caused considerable problems. The results of these problems included excess design, construction and overhead costs; facility designs which had to be scaled down to meet budget constraints and thus did not effectively meet mission requirements; and delays in project design and construction which led to additional costs of inflation and delayed facility beneficial occupancy.

The frequency of such occurrences provided the impetus for a new look at the total project development process by a committee for the purpose of making recommendations for improvements in the process in order to minimize or eliminate the types of experiences cited above.

In recognition of the severity of the problems identified, the command established an ad-hoc committee composed of six senior members of the Planning and Acquisition Departments. The committee's charter was to examine both the planning process and the acquisition process in some detail, to determine and define the interfaces between the two departments at the transition stage, and to develop recommendations to minimize the difficulties already enumerated, as well as to facilitate the transition between planning and design.

After several meetings which were devoted to cross familiarization of the membership regarding each others' particular process, the committee next turned its attention to the types of projects which most frequently encountered difficulties in the PED stage of project development. Although it is intended that every project scheduled for accomplishment in a particular year be reviewed for applicability of the two-phase process, certain types of projects have historically been troublesome and were therefore considered likely candidates for the new approach.

Typically, the projects to be considered will be those listed in the MCON Budget Year Report for the fiscal year which occurs three years later than the current fiscal year, i.e., FY 1983 + 3 = FY 1986. This procedure is in accordance with the established budget cycle schedule for development of the MILCON Program. All projects approved by the Shore Facilities Planning Board (SFPB) for inclusion in the MCON Budget Year Report will be considered as potential candidates for pre-design study but particular emphasis will be afforded the following categories of facility project types:

- Waterfront reconstruction projects (piers, drydocks, wharves, cold iron)
- Projects involving dredging, or construction in wetlands or floodplains
- Applied instruction building projects
- ADP/computer/RDT&E facilities projects
- Projects involving the renovation or conversion of historic structures
- Utilities projects (boiler plants & power plants)
- Projects involving the installation of industrial equipment or the generation of industrial waste products
- Projects involving sequential or incremental phasing of work in separate program years (site or area master planning)
- Projects with basic electronic system engineering plan (BESEP) interface
- Reserve training centers (surface reserve)

This list was not meant to be all inclusive, since the depth and breadth of experience of the committee members will allow for the exclusion of certain of the project types or the inclusion of other types when warranted. In addition, late "add-on" projects not yet programmed by the SFPB are considered in this process.

The candidate list of projects for which some type of advance or pre-design work is considered appropriate by the committee is, after its formulation, screened through the appropriate departments and divisions and is then reviewed for approval by the executive officer. The approved list is next forwarded to the planning department head for solicitation of funding.

Funding by the activity or major claimant is key to the success of the two-phase concept since neither Program II funds

nor Z Planning funds can be used for this intermediate effort which essentially is situated between the somewhat limited activity level planning and the detailed design of a project.

For projects which have been determined to need a pre-design study, the appropriate activity/claimant is notified to explore the possibility of obtaining necessary study funds. Potential methods of accomplishment are also proposed for consideration by the claimant, i.e., in-house by Northern division, by A/E contract administered by NORTHDIV, by PWO in-house, or by PWO administered A/E contract, and the appropriate amount of funding required to conduct or administer the study is identified.

Because of the express need to submit the proper forms and facility study to CNO in the May/June time frame, it is essential that the funding solicitation process be completed by January 1 so that the A/E slate/selection procedures and clearance aspects can be accomplished in a timely manner.

Therefore, for each pre-design study which the activity or claimant agrees to fund, the Installations Planning Division Project Manager assumes lead for preparation of the Commerce Business Daily (CBD) announcement, and coordinates all tasks related to the study effort until the CBD is issued.

During this coordination period, the director, Installations Planning Division, tasks the lead branch or organizational component to provide input to the CBD announcement, and to develop the initial scope of work and government estimate for the study. In all cases, the designated lead component must: ensure that coordination between committee members does take place, communicate all required information to involved committee members and project participants, and provide guidance as the study manager.

It is imperative that each individual committee member participate in the CBD and scope development process to the extent necessary to ensure that all appropriate engineering, architectural and planning considerations have been adequately addressed.

Depending upon the type of project to be studied, and the corresponding expertise or disciplines required to best manage the particular pre-design or up-front study, the ad-hoc committee established project lead component assignments as follows:

Director, Installations Planning Division, is lead component for:

- Waterfront reconstruction projects
- Reserve Training Centers where MCNR programming documentation, i.e., forms, and facility study, is lacking
- Renovation or conversion of historic structures
- Projects involving dredging, for construction in wetlands or floodplains
- Project involving sequential or incremental phasing of work in separate program years (site or area master planning)

Head, Architectural Branch, is lead component for:

- Applied instruction buildings
- ADP/computer/RDT&E facilities
- Medical/dental facilities
- Reserve Training Centers for which preliminary MCNR programming documentation has been completed, but architectural and engineering considerations, including facility interfaces and logistics support requirements have not been adequately addressed.

Head, Mechanical Branch, is lead component for:

- Utilities Projects (Boiler Plants & Power Plants)
- Major Industrial Projects (Equipment Installation/Industrial Waste Products)
- Unique facilities which require the installation of complex mechanical or electrical training, production or R&D equipment
- Projects with BESEP interface

Finally, the ad-hoc committee, in developing its procedures, recommended inclusion of the following policy statement with regard to Two-Phase Planning and Design contracts:

It is intended that (Phase I) study efforts will be awarded as two-phase contracts, with project design (Phase II) to be included as an unpriced option to the original study contract. However, prior to the award of Phase I, all procedural requirements of NAVFAC P-68 will be satisfied, particularly the synopsizing of project particulars in the Commerce Business Daily (CBD), and the obtaining of all necessary business clearances based on the estimated dollar value of the A/E fee for all phases of work and options included in the contract.

Successful and satisfactory completion of the study phase will, except in unusual cases, permit follow-on award of the design option to the same A/E, thereby facilitating earlier design and construction awards, increased efficiencies and effectiveness in the design process and cost avoidance due to inflation.

A/E selection will be based on the ability of the firm to satisfactorily accomplish both the Phase I and Phase II aspects of the project, and qualifications of the firm should be evaluated with this in mind. It is therefore important that slate/selection board composition be tailored to best fit the project requirements with representation from each of the involved components.

The ad-hoc committee which drafted the necessary procedures and recommendations essentially became the permanent committee to oversee implementation of the Two-Phase process. Two membership changes were made: The Head, Planning Systems Branch, was substituted on the committee for Team Leader, MCON, and the Head, Energy Programs Branch, was added to the permanent committee to ensure energy considerations were appropriately integrated into the Two-Phase process.

As a means of control over the program, the committee also tasked itself to review the findings and recommendations of each study to ensure that the final product adequately

addresses all pertinent aspects, issues and considerations applicable to the project.

The result of the committee's work is an instruction which establishes Two-Phase (Planning/Design) Architect/Engineer (A/E) Contracts. Under this procedure, in Phase I, the A/E firm performs planning or pre-design studies to define project scope, cost, and support requirements. After satisfactory completion of the Phase I process, the A/E firm proceeds to project design in Phase II. This process also applies to projects done by "In-house" design teams.

The Two-Phase contract process accomplishes two objectives. First, project planning documents are more complete as a result of a thorough study of approaches to meeting mission requirements. An outside A/E firm often perceives projects from a different viewpoint, and can offer innovative solutions to Navy problems. Secondly, having the same A/E firm do both planning and design saves significant time by not having to perform the advertise, slate, select, and project familiarization process twice.

As previously indicated, lead branch assignments for management of the Phase I portion of Two-Phase contracts are divided among the Installations Planning Division, Planning Systems Branch, and the Architectural and Mechanical Branches of the Design Division. Design Division branches handle the follow-up design (Phase II) portion of the contracts.

A highly successful example of the application of the Two-Phase contract process is the Diesel Engineman's Accession Training Facility, Navel Training Center, Great Lakes, Ill. The contract consists of two projects which were supported by the major claimant, but were not listed by the OPNAV Shore Facilities Planning Board on the MCON Program lists. Both projects needed fiscal year programming and funding requirement approvals.

Project No. 1 is an FY-84 unspecified minor MCON project consisting of a 6,000 SF building to house an operational diesel engine propulsion system used on ARS-50 class ships. Supporting utilities, pollution abatement equipment, and noise suppression systems will also be provided.

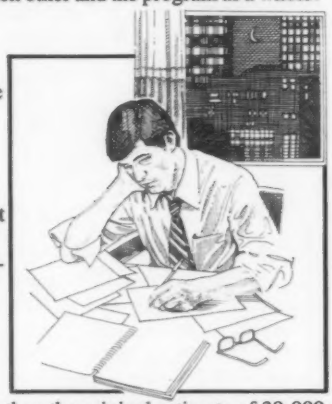
Project No. 2 is an FY-86 MCON project consisting of a 48,300 SF building to house classrooms, engineering control console trainers, laboratories, and administrative facilities.

Both projects will provide generic training for engineman in operation and maintenance of diesel engines and auxiliary equipment. Phasing of the projects will enable the training command to begin "hands-on" engineman training by 1986 to meet manpower requirements for new ship deliveries. Classroom instruction will follow upon completion of P-456 construction by 1987. Since these projects were late "add-ons," programming approvals were dependent on the timely preparation and submittal of accurate forms and facility study documentation.

The A/E firm for this contract did an outstanding job of preparing detailed planning documentation in seven weeks to meet the deadline. Their task included research, development, preparation, and validation of Activity requirements, and coordination with several different Navy commands.

Concentrated efforts in the planning phase led to early formation of the project team with players representing all involved parties — SERVSCOLCOM, NTC and PWC Great Lakes; CNTECHTRA; CNET; NAVSEA; NAVSEASUPPCENLANT, Philadelphia; NORTHDIV and the A/E firm.

Development of good working relationships and emphasis on mutual cooperation in meeting project goals were some of the positive results of this process. Inclusion of all parties in on-board reviews of the A/E's planning submissions led to in-depth consideration of all project elements necessary to support the training mission, and clarified the relationships of individual items to each other and the program as a whole.



By critical path analysis of the complete program schedule, the A/E identified a requirement for HAVSEA to move up equipment procurement for proper installation interface with the building construction process. Also, the space requirement for the P-456 facility was determined to be 48,300 SF; much more than the original estimate of 30,000 SF. The corresponding cost impact was reflected in the cost estimate and project planning documentation. These items are typical of areas that were often omitted, poorly estimated, or disregarded on past project submittals. Northern Division expects to realize similar results on future project planning submittals.

The cooperative and coordinated project team concept, and on-board reviews of interim A/E submissions allowed all project reviewers in the chain of command to meet an accelerated schedule of review and certification of final programming documentation set by NORTHDIV to meet deadlines for project submittal for programming by the SFPB.

Under normal project planning methods, preparation of a project and facility study, and any corresponding planning research effort has been completed before the project is submitted to the EFD. The Two-Phase Planning/Design program based on screening of the MCON budget year report allows early EFD input into planning of projects of the types which have historically had inadequate planning documentation and resulting design problems.

The Two-Phase (Planning/Design) A/E Contract has proven to be a most successful tool for minimizing costly, unforeseen changes during project design. □

speaking from topside

departments

The "Fourth Corps" . . .A destinctive group

I'm more inclined to look ahead than astern, but for a moment, look back with me . . .

To be sure, the CEC has been a wonderful career — full of excitement, challenge, amazement, some frustration, and occasionally a touch of awe. I've had substantially more good luck than bad, and have been blessed to be in the finest organization in the Navy . . . the Civil Engineer Corps.

They say all Gaul was divided into three parts . . . and I think the Corps was, too, for me.

The "first Corps" welcomed me as a young officer. I was surprised at two things then. I could take on as much responsibility as I could possibly handle; but anytime I needed help, it was there. Not with a spoon, but with a lamp . . . and responsibility and help came from the same source: senior officers then in the Corps. Those officers had fought and won WW II; they were our first Seabees; they had participated in the greatest military/industrial mobilization ever; and they had contributed to the rise of the United States to a position of world preeminence. Individually and as a group, they were officers secure in their capabilities, and willing to loosen the reins on a young officer. It wasn't easy, but it was good fun, because it was really part *mine*.

Time passed. . . . I was a senior Commander and a junior Captain in the "second Corps." By then, I knew, or knew of, most of my contemporaries. When the subject of a particular naval station or naval activity came up, I automatically thought of it in terms of "who was there." I was now fully aware of the informal network of communications that existed among us, and realized that we had become increasingly reliant on each other. We shared successes, and we shared an increasing responsibility for running the Corps . . . and, thence, a substantial part of the Navy. We were expected to take a world-view on issues, to be objective, to be professional, and to be more the givers than the receivers of guidance. We were a band of brothers in service to our country, each helping the other.

Somewhere about the 24-year point, I found myself joining the "third Corps." The transition was subtle, and had only a little to do with one's prospects for selection to flag. It was much more a joining of that group of senior captains who undeniably run the show. These officers know that they could all be flag officers of great distinction . . . but only a very few will get that opportunity. Still they serve, and serve magnificently. They pay much attention to nurturing the growth of younger officers; to adjusting the organization to deliver products and services more rapidly and efficiently; to positioning the Corps best to serve our Navy and our country in the years to come, and to providing the personal example and leadership that any successful organization *must* have. Officers in the "third Corps" have *stayed the course*, and we are stronger for it.

Three Corps? . . . . one Corps? . . . No difference; all of us are bound by a single purpose.

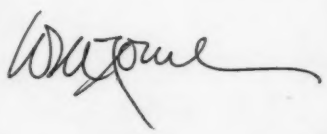
Ahead?

First, I'm not leaving the Navy. The time has come to transfer from the active list to the retired list of officers, and remain available for service as the Secretary may require.

Second, I'm not leaving the Corps.

Instead, I'm joining the "fourth Corps": a group of talented and energetic retired officers who still contribute their talent and energies in many ways.

Finally, I pass with every confidence and good wish, the roles and titles of Chief of Civil Engineers and Commander of NAVFACENGCOM to my good friend and associate, Rear Admiral John Paul Jones, Jr. In good hands . . . *both* of you. You have the best of all worlds . . . and you deserve it, because you made it yourselves.



WILLIAM M. ZOBEL
Rear Admiral, CEC, USN
Commander
and
Chief of Civil Engineers

READINESS:

Skills are important of course, but there also exists a need to prepare for conflict and defense

By LT K. G. FORTNER, CEC, USN
Training Officer, NMCB-133
Gulfport, Miss.
E.I.T., Ala.

Photos by PH2 Randy Shank

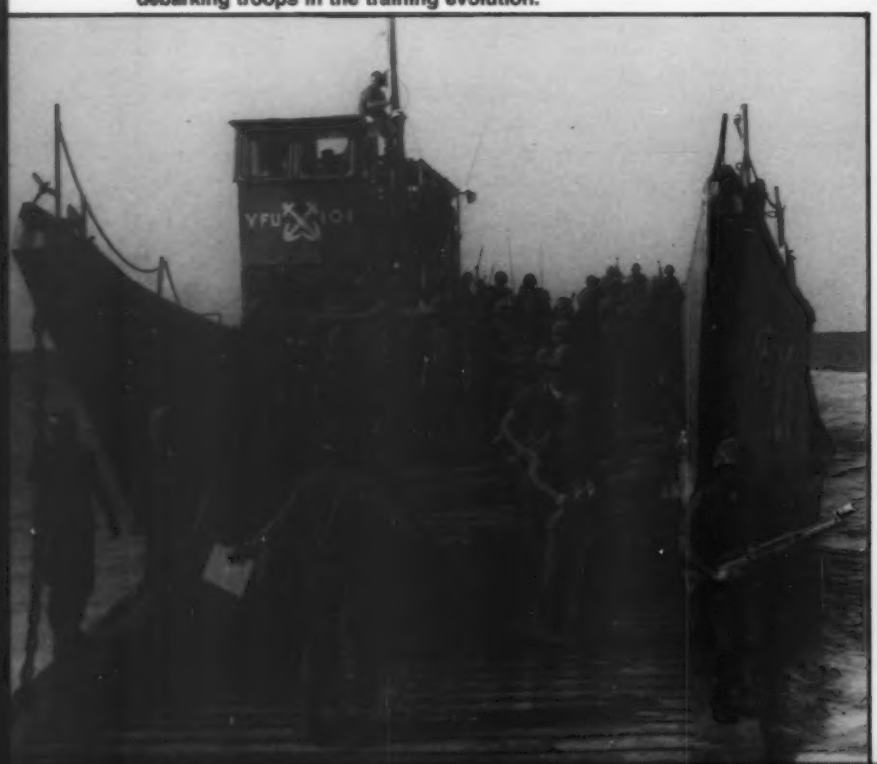
Readiness has received renewed emphasis within the Naval Construction Force, readiness in the areas of both construction and combat skills. While there is a profound difference between the two, there are many occupational field-13 personnel and Civil Engineer Corps (CEC) officers who can recall a simultaneous need for both.

Military preparedness and the ability to conduct combat operations are part of the overall mission of the construction battalion. While the majority of CEC officers are quite distant from the regimens of defensive combat, it takes but a short time in a construction battalion to recognize the impact of its secondary mission.

"We build, we flight" are watchwords that we certainly hope not to prove again, but growing world tensions prevent one from comfortably assuming that we will not again be involved in conflict, advanced base or contingency construction — scenarios which will require military skills.

Development of combat skills comes through training which is conducted both on deployment and during the

Amphibious landings in a hostile zone cannot be overlooked. GYSGT James Randall (extreme left) and CW02 Randall Harris (forefront) direct the debarking troops in the training evolution.



34 graduates on worldwide assignments

Thirty-four new officers joined the ranks of the U. S. Navy's Civil Engineer Corps on March 2, 1984 upon graduation from the Naval School, Civil Engineer Corps Officers, Port Hueneme, Calif., and have accepted assignments all over the world.

Class Number 170 completed eight weeks of specialized training pertinent to the Navy's needs for shore installation engineering, public works management, and Seabee operations.

Five graduated with honors: Ensign Mark D. Buffkin was the outstanding graduate. Four graduated with distinction: Ensign Christian N. Baudhuin, Lt. Caryl L. Erickson, Lt. Randall L. Hoffman, and Ensign Kenneth E. Murphey.

Ensign Buffkin's photograph is indicated by (★). Those graduating with distinction are indicated by (●) and those entering Seabee duty by (†).

★†Ens Mark D. Buffkin
BSCE/The Citadel
to Port Hueneme, Calif.

Ens Joseph A. Angell
BSCE/U. of R.I.
to Gulfport, Miss.

●Ens Christian N. Baudhuin
BSCE/Utah State U.
to Griffiss AFB, N.Y.

†Ens Stephen S. Bell
BSCE/U. of Va.
to Gulfport, Miss.

Ens Keith D. Berndt
BSCE/N.D. State
to Monterey, Calif.

†Ens Daniel M. Bleakley
BSCE/Cal. State U.
to Port Hueneme, Calif.

Chemical warfare is a definite threat, and it reaches even the Command Operations Center. Communicating through gas masks is definitely not an easy matter.

homeport period. Homeport finds the battalion pursuing extensive training programs under the auspices of the respective regiment. Toward the latter portion of the homeport period, the Military Training Department conducts a week of concentrated Combat Skills Training (CST) culminated by a Field Training Exercise (FEX).

While on deployment, the battalion mainbody is tasked with conducting a one-week stand down from construction operations in order to effect one week of CST and an FEX. This training and the exercise is the responsibility of the battalion. Planning for and conduct of the evolution are coordinated at the deployment site, emphasizing correcting deficiencies observed in homeport and refreshing/improving skills already learned.

The primary concern of the construction battalion in combat is defense — how to best protect itself while deployed to a hostile zone. Typically, the scenario for Seabee deployment involves operations within a protective envelope of a Marine-held tactical area of responsibility (TAOR). This implies that there would exist a primary Marine force offering protection through control of the geography surrounding the Seabee operation area.

Despite the philosophy, we are quickly reminded that in hostile situations, with guerilla warfare tactics employed by enemy forces, secure areas do not exist. Additionally, the probability of the scenario developing as forecasted has come under question. That probability is not 1.0, and accordingly, the battalion must be prepared to defend itself without presence of a Marine force.

What then does a battalion do to prepare itself for combat action? Classes, practical applications, seminars, proficiency courses, and field training contribute to development of a readiness posture. Squad leaders attend specialized training in homeport, as do the chief petty officers and officers.

The Air Detachment, which would be the first unit to deploy to a contingency site, undergoes extensive training to prepare the 89-man unit for advanced base construction under severe conditions. Training efforts are overseen by the regimental staff while in homeport and by the battalion training department while deployed.

During July 1983, NMCB-133 conducted deployed combat training on Vieques Island, Puerto Rico. The training provided a different flare as movement to the contingency area was effected through an amphibious landing and a one-and-a-half mile tactical foot march. Once on site, the situation become more familiar as the operations

The prepared battalion leaves the field exercise, led by the Commanding Officer, CDR A. A. Kannegieser, and the Command Master Chief, CUCM Patrick Haley.

Lt Nicholas C. Cimorelli
BSISE/U. of Southern Calif.
to Quantico, Va.

Lt Mark D. Clausen
BSOE/USNA
to San Diego, Calif.

Ens William T. Cole
BSCE/Texas A&M U.
to New Orleans, La.

Ens Joseph M. Deskin
BSCE/Northwestern U.
to Barstow, Calif.

Ens Manuel Delgado-Ruiz
MA Arch./U. of Wis.
to Norfolk, Va.

•Lt Caryl L. Erickson
BSMC/U. of Wis.
to Charleston, S.C.

Ens Thomas J. Foust
BSCE/U. of Tenn.
to Virginia Beach, Va.

Lt Harry A. Gravely
BSEE/The Citadel
to Atsugi, Japan

Ens Bryan R. Hoelzig
BSCE/Wash. State
to Lemoore, Calif.

Ens Thomas G. Helmi
BSCE/Mich. State U.
to Warminster, Pa.

Ens Stanley G. Henderson
BSCE/Clemson U.
to Alexandria, La.

•Lt Randall L. Hoffman
BSEE/Kansas U.
to Barbers Point, Hawaii

Ens Julian B. Irby
BSME/Florida Atlantic U.
to Millington, Tenn.

Ens Scott L. Larson
BSCE/U. of Minn.
to Guantanamo Bay, Cuba

officer and company commanders established the battalion defensive perimeter and command post compound.

Over the course of the next eighteen hours, the battalion dug in with defensive positions, exercised communications skills, gathered intelligence information, practiced fire, noise, and light discipline, and drilled command and control procedures. Key contributions to the testing process were the Marines comprising the aggressor force, who were responsible for the assaults requiring battalion response.

As the battalion maintains its security through the course of the exercise, each member gains valuable practice necessary to improve survivability during an actual contingency.

The ultimate maneuver in defense is activated at the close of the exercise as the battalion is forced to execute a final protective fire. This action is taken to repel an all-out assault by enemy forces and requires the battalion to fire its weapons in unison to create a protective curtain around the perimeter. The curtain is, of course, the bullets and ordnance fired from positions named by the men of the line companies and support units.

Effectively repulsing the enemy, follow-up actions of caring for casualties, initiating resupply, and ensuring maintenance of battalion integrity, processes the exercise through to completion. As the troops clean up and prepare to depart the site, the umpires and battalion staff compile notes on the conduct and outcome of the exercise.

Invariably, the battalion is victorious in the overall scheme, but each company commander, company chief, platoon commander, and staff member must realistically appraise the action. Reflections always call upon the "what if" considerations. Frequently, a comfortable feeling prevails when contemplating potential actual results. Periodically, however, there is a sense of concern that hints at the need for more training, more practical application, more experience.

Regardless of what may be considered as the odds against active involvement in conflict, where there is a remote possibility, there exists a need for preparation — for readiness. We all plan to survive the exercises — we must have the confidence and capability to survive the real thing.

Construction is an activity that lends itself readily to motivation and enthusiasm. Combat is quite a different matter. Quality training in military proficiency is difficult to obtain and practical application time is limited. The point to be made is that readiness requires accommodation of all facets of the unit's mission, the pleasant and unpleasant. Regardless of the nature of the assignment, we must be adequately prepared to render the best effort possible.

The military training conducted by Seabee battalions is vital to their capabilities and the confidence of the commanding officer. For a brief period of time, twice every 14 months, the officers and men of the Naval Construction Force recognize the importance, and the demands, of its secondary mission: military readiness.

The hand grenade is a potent defensive or offensive weapon. That small ball of steel produces a tremendous blast.

Ltjg Edward M. Matey
BSCE/W. Va. U.
to Pensacola, Fla.

Lt Peter F. Mathews
BSME/USNA
to Virginia Beach, Va.

oEns Kenneth E. Murphey
BSCE/Kansas State U.
to Misawa, Japan

Ens Joseph G. Orlowsky
BSCE/Penn. State U.
to Philadelphia, Pa.

Ens James M. Pace
BSCE/Brigham Young U.
to Indianapolis, Ind.

Ens Jeffrey R. Phillips
MSAG/Penn. State U.
to Subic Bay, R.P.

Ens Mark Roach
ME/Rensselaer Polytech
to Norfolk, Va.

Ens Thomas J. Rodina
BSCE/Penn State U.
to Earle, N.J.

Ens Keith W. Tyson
BSME/Texas Tech.
to Stockton, Calif.

Ens Brian S. Vincent
BSCE/Wash. U.
to Oakland, Calif.

†Ens Jeffrey D. Voltz
BSCE/Delaware U.
to Gulfport, Miss.

Ens James A. Worcester
BS Arch./Cal. Poly. U.
to Antarctica

Ens Suzanne S. Young
BSCE/U. of R.I.
to Oakland, Calif.

Ens Mark A. Zaleski
BSCE/U. of Calif.
to Monterey, Calif.

Have you considered the

RESERVES?

In addition to the opportunities for challenging and rewarding careers in the active duty Navy Civil Engineer Corps, there are similar career opportunities in the Reserve Civil Engineer Corps.

If you are a young construction professional in civilian practice or civil service, or are a graduating engineering or architecture college senior who has already selected a civilian career path, the Reserve CEC may have a place for you as a commissioned officer.

Qualified young professionals have the chance to achieve tremendous personal and professional satisfaction through . . .

- Direct appointment as an Ensign, Civil Engineer Corps, United States Naval Reserve
- Challenging assignments within Reserve Naval Construction Force units in your geographic locale, in areas parallelling active CEC duty in the Seabees or in facilities management
- Annual active duty for training that is meaningful and rewarding
- Development of leadership and technical skills that will carry over directly into your civilian profession
- New and lasting friendships and associations with other top-notch construction professionals
- Pay and responsibility that increases as you grow and advance
- A Naval Reserve retirement package for a little something extra in your old age
- Finally, and most importantly, the pride in knowing that you are helping preserve the freedom of your country as you grow in your profession

Here's what you can do . . .

If you are a young engineer or architect, male or female, please call the the Reserve Representative listed below.

LCdr. Pete Saunders
Eastern Region, RNCF
Bldg. 662, Naval Base
Philadelphia, PA 19112
Phone: (215) 897-5831/34
AV 443-5831/34

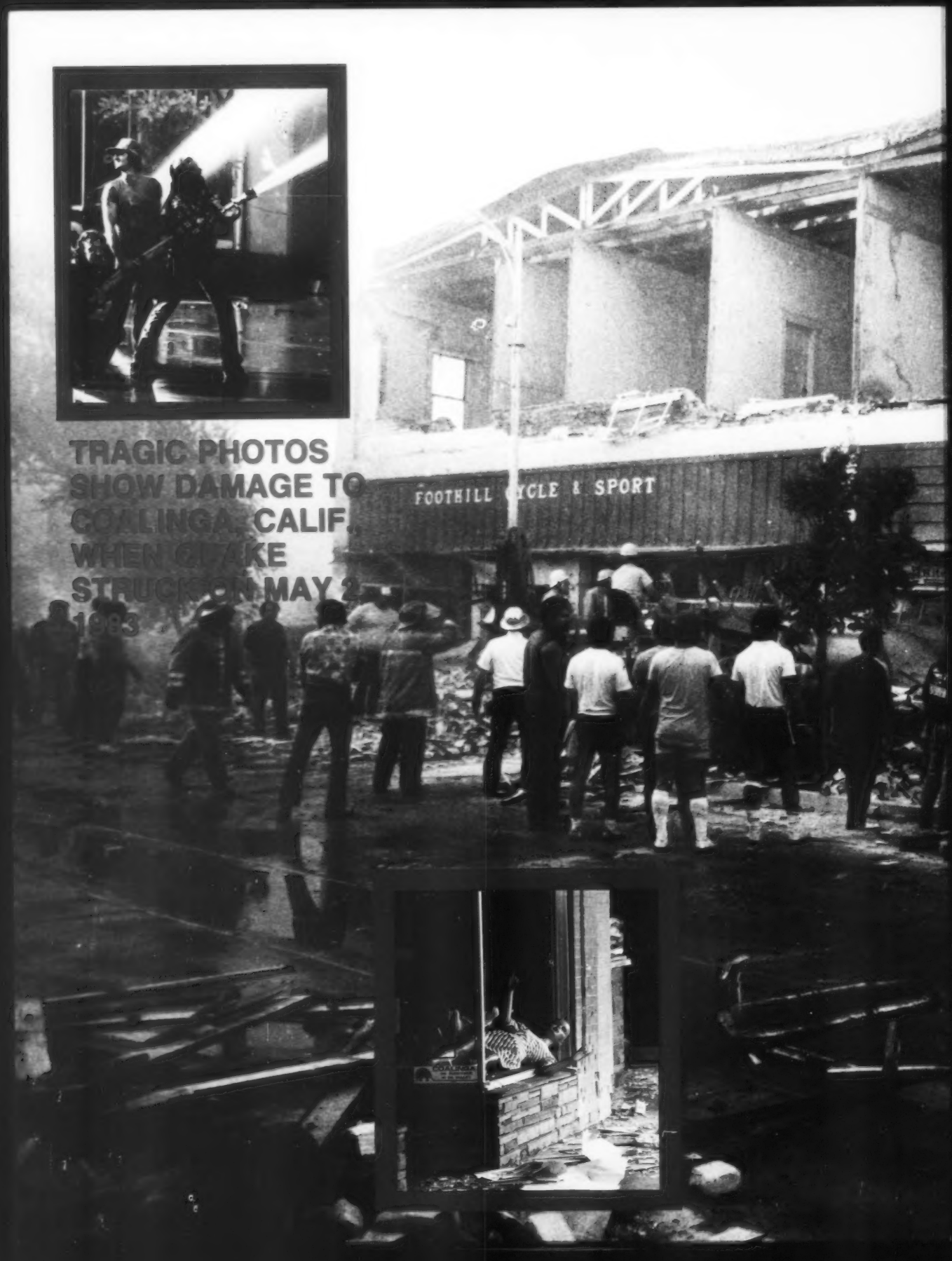
Lt. Robert D. McClure
Central Region, RNCF
Bldg. 1, Naval Base
Great Lakes, IL 60088
Phone: (312) 688-6955/6
AV 792-6955/6

LCdr. Howard Huggins
Southern Region, RNCF
Naval Base
Charleston, SC 29408
Phone: (803) 743-2650/4322
AV 794-2650/4322

LCdr. Russ Pabarcus
Western Region, RNCF
1220 Pacific Highway, Suite 203
San Diego, CA 92132
Phone: (619) 235-3401/2
AV 958-3401

Or, contact an Active Duty EFD Accessions Officer listed on the inside front cover for further information and details. . .

Call now (collect)...

You and the Reserve Navy Civil Engineer Corps may be meant for each other.

TRAGIC PHOTOS SHOW DAMAGE TO COALINGA, CALIF. WHEN QUAKE STRUCK ON MAY 2, 1983